10/1/04-01236

Final

# Site Investigation Work Plan
# Site 23 – Building LP-20 Plating Shop

## Naval Station Norfolk
## Norfolk, Virginia

NAVFAC
Naval Facilities Engineering Command

**Prepared for**

## Department of the Navy

### Naval Facilities Engineering Command
### Atlantic


Contract No. N62470-02-D-3052
CTO-0066

**October 2004**


**Prepared by**

CH2MHILL

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## Naval Station Norfolk Norfolk, Virginia

Contract Task Order 066

## Department of the Navy
## Atlantic Division
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## Norfolk, Virginia

LANTDIV CLEAN III Program
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*Prepared by*

CH2MHILL

Virginia Beach, Virginia

October 2004

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**Figures (Figures are located at the end of each section.)**

# Acronyms and Abbreviations

| | |
|---|---|
| AS/SVE | Air Sparge/ Soil Vapor Extraction |
| asl | Above Sea Level |
| bgs | Below Ground Surface |
| BRA | Baseline Risk Assessment |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| CLP | Contract Laboratory Program |
| COC | Change of Custody |
| DCA | Dichloroethane |
| DCE | Dichloroethene |
| DPT | Direct Push Technology |
| EDD | Electronic Data Deliverable |
| ERA | Ecological Risk Assessment |
| FEMA | Federal Emergency Management Agency |
| FS | Feasibility Study |
| FSP | Field Sampling Plan |
| ft | Feet |
| GIS | Geographical Information Systems |
| GPS | Global Positioning System |
| HASP | Health and Safety Plan |
| HHRA | Human Health Risk Assessment |
| IDW | Investigation-Derived Waste |
| IR | Installation Restoration |
| IWS | Industrial Wastewater Sewer |
| NADEP | Naval Aviation Depot |
| NAVFAC | Naval Facilities Engineering Command |
| NSN | Naval Station Norfolk |
| PAH | Polycyclic Aromatic Hydrocarbons |
| PPE | Personal Protective Equipment |
| PRI | Pre-Remedial Investigation |
| QAPP | Quality Assurance Project Plan |
| QA/QC | Quality Assurance/Quality Control |
| RCRA | Resource Conservation and Recovery Act |
| RI | Remedial Investigation |

| | |
|---|---|
| Shaw E & I | Shaw Environmental and Infrastructure, Inc. |
| SI | Site Investigation |
| SOP | Standard Operating Procedure |
| SVOC | Semivolatile Organic Compound |
| TAL | Target Analyte List |
| TCE | Trichloroethene |
| TCL | Target Compound List |
| USEPA | Unites States Environmental Protection Agency |
| UST | Underground Storage Tank |
| VC | Vinyl Chloride |
| VDEQ | Virginia Department of Environmental Quality |
| VHWMR | Virginia Hazardous Waste Management Regulation |
| VOC | Volatile Organic Compound |
| WP | Work Plan |

SECTION 1

# Introduction

This Work Plan (WP) describes the Site Investigation (SI) activities that will be conducted at Installation Restoration (IR) Site 23 - Building LP-20 Plating Shop located at Naval Station Norfolk (NSN), Norfolk, Virginia (Figure 1-1). This Work Plan is based on the previous investigations at the site and presents the scope of work for an additional investigation as part of Navy Contract N62470-02-D-3052, Comprehensive Long-Term Environmental Action Navy (CLEAN), District III, Contract Task Order - 0066. The approach for this Work Plan was joint-scoped with the NSN Tier I Partnering Team in January 2004.

The general background and physical setting of NSN is described in Sections 3 and 4 of the Master Project Plan, prepared by CH2M HILL in October 1997. This SI Work Plan contains the following sections:

- Section 1 – Introduction
- Section 2 – Site Background
- Section 3 – Sampling Rationale
- Section 4 – Site Investigation Tasks
- Section 5 – Staff Organization
- Section 6 – Estimated Project Schedule
- Section 7 – References

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Site 23 - Building LP-20 Plating Shop

Figure 1-1
Installation Location Map
Naval Station Norfolk
Norfolk, Virginia

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SECTION 2

# Site Background

## 2.1 Site History

As shown in Figure 2-1, Building LP-20 is one of many large buildings located northwest of the Chambers Field main runway. Currently, the building is used as a motor pool and office space. In the past, a portion of the building was used for aircraft engine overhaul and maintenance. Previous activities at the building included painting, x-ray facilities, cleaning and blasting, and a metal-plating operation. Rinsewaters generated from these activities were transferred to the industrial wastewater treatment plant via underground piping. In addition, a large fuel storage area, known as LP fuel farm, is located south of the building. An underground pipeline extends from the Fuel Farm to Buildings LP-78 and LP-176 which are located east of the site. Between the 1940s and 1990s, numerous spills or releases of wastewater and petroleum have been documented. Significant releases were associated with damage to underground wastewater lines during construction activities, and leakage of the underground petroleum pipeline (Baker Environmental, Inc., December 1995).

The groundwater plume resulting from these activities was designated as IR Site 20 - Building LP-20 site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The approximate boundary of the plume as determined from the Site 20 Remedial Investigation (RI) is shown on Figure 2-1. A Remedial Investigation/Feasibility Study (RI/FS) (Baker Environmental, Inc., December 1995) was completed for Site 20 in 1995 and an air sparge/ soil vapor extraction (AS/SVE) system was installed and began operation in 1998. Currently, Site 20 is part of the Long-Term Monitoring program at NSN.

The Plating Shop at Building LP-20 was originally under the Resource Conservation and Recovery Act (RCRA) program, however, in July of 2003 the site was moved into the CERCLA program and designated as Site 23 - Building LP-20 Plating Shop. The boundary of Site 23 is shown on Figure 2-2.

Site 23 is located on the west side of LP-20. The Plating Shop is currently not in use. The shop contains seven process pits that extend beneath the concrete slab floor and were used for cleaning, stripping, and plating engine parts. The process tanks and equipment were also located in pits. The floor and pits were lined with corrosion resistant brick tiles.

During a 1989 site visit, the Virginia Department of Environmental Quality (VDEQ) observed violations of the Virginia Hazardous Waste Management Regulations (VHWMRs). These violations included hazardous waste stored in excess of 90 days, hazardous waste stored in tanks without interim status or a permit, and containers not clearly marked as hazardous waste. The violations also included the lack of inspection records and notification of exact locations of all existing accumulation areas.

An enforcement order for the Plating Shop was issued in December 1990. Under the RCRA program, a Clean Closure Plan and Contingency Plan were completed in 1993 and approved by VDEQ in September 1994. The Navy requested a modification of the plans in order to conduct a risk-based closure. Multiple phases of investigation were conducted for partial implementation of the Risk-Based Closure Plan (Versar, Inc., December 1997). The investigation included the collection of soil, concrete, and groundwater samples that were analyzed for select volatile organic compounds (VOCs), cyanide, and eight metals. The risk assessment demonstrated that there was an unacceptable risk, with metals (cadmium, hexavalent chromium, and nickel) as the main risk drivers, however, no unacceptable risks were associated with exposure to concrete. The closure plan recommended that the groundwater be addressed under a post-closure monitoring program. Final closure was not achieved under the RCRA program. However, partial closure that included the removal of the tanks and the piping for decontamination or disposal as hazardous waste did occur. In September 2000, a revised Clean Closure Plan (Versar, September 2000) was submitted to VDEQ. The scope of the revised plan included the general cleanup and decontamination of the Plating Shop, removal of the top 3 feet of soil beneath the Plating Shop, and removal or rerouting of underground utilities beneath the Plating Shop. Since the submittal of the revised Clean Closure Plan and the Contingent Closure Plan by Versar, Inc. in September 2000, there has been no activity at the Plating Shop.

## 2.2 Previous Investigations

Site 23 (Building LP-20 Plating Shop) is located within the boundary of Site 20 (the Building LP-20 site area), therefore, the results of previous investigations at Site 20 can be used in part to evaluate the contamination within the LP-20 Plating Shop. This section summarizes the Pre-Remedial Investigation (PRI) and RI activities conducted in the LP area as well as the RCRA Investigations conducted at Site 23.

### 2.2.1 LP Area Pre-Remedial Investigation

Eleven separate pre-remedial investigations were carried out between September 1986 and May 1994 in the LP area. The investigations were performed primarily to characterize contamination suspected to originate from both the LP Fuel Farm (south of Building LP-20), past industrial activity in the LP-20 area, and underground storage tanks (USTs) in the area. The objective of these investigations was to assess the subsurface soils and groundwater for petroleum contamination. There were 95 soil borings and 95 monitoring wells installed during these investigations. The investigation results showed widespread chlorinated solvent and petroleum contamination in the vicinity of Building LP-20. All PRI sampling locations are presented in Figure 2-3. Additional information on each of these pre-remedial investigations is detailed in the *Draft Final RI and Baseline Risk Assessment for Building LP-20 Site* (Baker Environmental, Inc., December 1995).

### 2.2.2 Site 20 Remedial Investigation

The RI consisted of five separate phases conducted between December 1994 and October 1995 (Baker Environmental, Inc., December 1995). The objectives of the RI are presented below:

- Determine the source area(s) of contamination associated with past industrial activities,

- Adequately define the nature and extent of environmental impact to the soils and groundwater in the vicinity of Building LP-20,
- Provide the necessary information to perform a public health risk assessment, and
- Provide the necessary information to screen alternatives to determine the most feasible methods for remediation, if necessary, of potential sources of risk to public health and the environment.

The Site 20 RI sampling locations are presented in Figure 2-3.

The results of the RI showed that VOCs, semi-volatile organic compounds (SVOCs), and metals were detected in soil (surface and subsurface) and groundwater (shallow and deep) samples collected in the Building LP-20 area. A number of contaminants in both soil and groundwater media were found to exceed applicable Federal or State standards and guidelines. The detected contaminants by media are summarized below:

- Surface soil; trichloroethene (TCE), polycyclic aromatic hydrocarbon (PAHs), aluminum, antimony, arsenic, and beryllium were predominant.
- Subsurface soil; acetone, TCE, 1,2- dichloroethene (DCE), PAHs, aluminum, antimony, arsenic, and beryllium were present.
- Shallow aquifer groundwater; two separate contaminant plumes - chlorinated solvent plume of vinyl chloride (VC), 1,2-DCE, and TCE is located in the vicinity of Buildings LP-20 and LP-26 and a petroleum (benzene) contamination plume extends from Building LP-176 to Bellinger Boulevard and east from Building LP-22 to Building LP-14.
- Deep aquifer groundwater; Yorktown Aquifer, predominant contaminants include VC, TCE, 1,2-DCE (total), and benzene. Inorganics such as iron, manganese, and sodium were present in concentrations exceeding water quality criteria (Federal maximum contaminant levels and /or Virginia Water Quality Standards).

The site contamination was attributed to the following sources:

- Past storage and transfer of petroleum products,
- Past storage and disposal area for chemical solvents used for cleaning, painting, and metal plating operations in the Building LP-20, and
- Releases of waste fluids through breaks in the Industrial Waste Sewer (IWS).

The RI and Baseline Risk Assessment (BRA) (Baker, December 1995) provide the complete risk assessment evaluation for Site 20.

### 2.2.3 LP-20 Plating Shop Site 23 RCRA Investigation

Three phases of activities were included in the RCRA Investigation. Phase I of the field investigation was conducted between February 19 and 29, 1996 at the former metal plating shop (currently known as Site 23) in Building LP-20 as detailed in the Clean Closure Plan (Norfolk Naval Base, February 1993). Evaluation of the results of the Phase I sampling indicated the need for additional delineation of soil contamination in the former plating shop area. Therefore, the Phase II investigation included additional subsurface soil sampling which occurred in October 1996. The Phase II data was incorporated into a Revised Closure Report, submitted to VDEQ in February 1997 (O'Brien and Gere, December 1997). Based on VDEQ's comments, three additional background soil samples were collected in December 1997 as Phase III of the investigation. Sampling locations and selected constituents considered to be a potential concern to human health are presented in Figure 2-4.

#### 2.2.3.1 Phase I Summary

The objective of the Phase I activities was to delineate the extent of contamination. The field investigation consisted of the collection of soil, concrete, and groundwater samples. A total of 26 shallow soil borings were sampled within the Plating Shop and former process units. Two deep soil samples were also collected along the IWS running through the Plating Shop. In addition, a total of eight soil samples were collected from background locations in the vicinity of Building LP-18. Groundwater samples were also collected from upgradient and downgradient locations as well as within the Plating Shop. Furthermore, five concrete floor samples within the Plating Shop and background concrete samples (from areas with little to no industrial activity) were collected.

#### 2.2.3.2 Phase II Summary

The objective of the Phase II investigation was to further delineate the areas of subsurface soil contamination where the concentrations of the Phase I sampling locations exceeded the risk-based criteria. Thirteen additional borings and 21 additional soil samples were selected to provide further horizontal and vertical delineation of contamination.

#### 2.2.3.3 Phase III Summary

The objective of the Phase III investigation was to evaluate the background soil conditions. Three additional background soils samples were collected during this sampling event.

#### 2.2.3.4 RCRA Investigation Analytical Results

Soil and groundwater samples were analyzed for select metals (cadmium, total chromium, hexavalent chromium, copper, lead, nickel, silver, and zinc), cyanide, and select total VOCs (1,1-dichloroethane (DCA), 1,1-DCE, 1,2-DCE, cis-1,2,-DCE, trans-1,2,-DCE, benzene, chloroform, dichloro-difluoromethane, methlylene chloride, ethylbenzene, toluene, TCE, trichlorofluoromethane, VC, and total xylenes). Background soil samples were analyzed for select metals and cyanide. It was assumed that VOCs would not be present in background samples and, therefore, were not analyzed. Concrete samples were analyzed for select metals, cyanide, and VOCs while the background concrete samples were analyzed for select metals and cyanide only. VOCs were assumed to not be present in the background concrete samples and, therefore, were not analyzed.

In the shallow soil samples (collected from a depth of 0-6 inches), eleven VOCs (chloroform, TCE, 1,2,-dichloroethene, methylene chloride, 1,1-dichloroethane, ethylbenzene, toluene, VC, xylene, trichlorofluoromethane, and cis-1,2 dichloroethene) were detected, with the highest concentrations generally in the vicinity of the former process areas. Cyanide was detected at eleven shallow borings and the highest levels were detected in the former process areas.

In the deep soil borings (collected from a depth greater than six inches), three VOCs (1,2-DCE, TCE, and VC) were detected at low levels. Nine of the deep soil locations indicated TCE concentrations less than the corresponding 0-6 inch interval. Cyanide was detected at lower concentrations in nine of the eleven locations collected from the 6-12 inch interval when compared to the samples collected in the shallow. For metals, generally the detected concentrations decreased from the 0-6 inch interval to the 12-18 inch interval in soil samples. However, chromium and lead concentrations increased with depth at two soil sample locations.

In background soil samples, eight metals (cadmium, total and hexavalent chromium, copper, lead, nickel, silver, and zinc) were detected. The highest detected concentrations were from two sample locations that were collected along a grassy area in the vicinity of Building LF-18 that is used for recreational activities.

In groundwater, two metals (hexavalent chromium and nickel) were detected in the downgradient sample locations at higher concentrations than the upgradient location. Cyanide was detected in only one groundwater sample that was located from within the facility. Three VOCs; 1,1-DCA, 1,2-dichloroethene, and VC were also detected. 1,1-DCE was detected from a downgradient location while 1,2-DCE and VC were detected from upgradient, downgradient, and within the Plating Shop.

With the exception of zinc, low concentrations of metals were present in the five background concrete samples. Cyanide was detected at each of the five concrete sample locations with the detected concentrations being one to two orders of magnitude greater at a sample location adjacent to the cadmium plating unit. For the five concrete samples collected within the metal plating shop, VOCs were most prevalent in the vicinity of the former chrome strip line while metals were most prevalent in the vicinity of the cadmium plating unit.

The RCRA Closure Report (O'Brien and Gere, December 1997) provides an in depth discussion of the risk assessment evaluation for the Building LP-20 site area.

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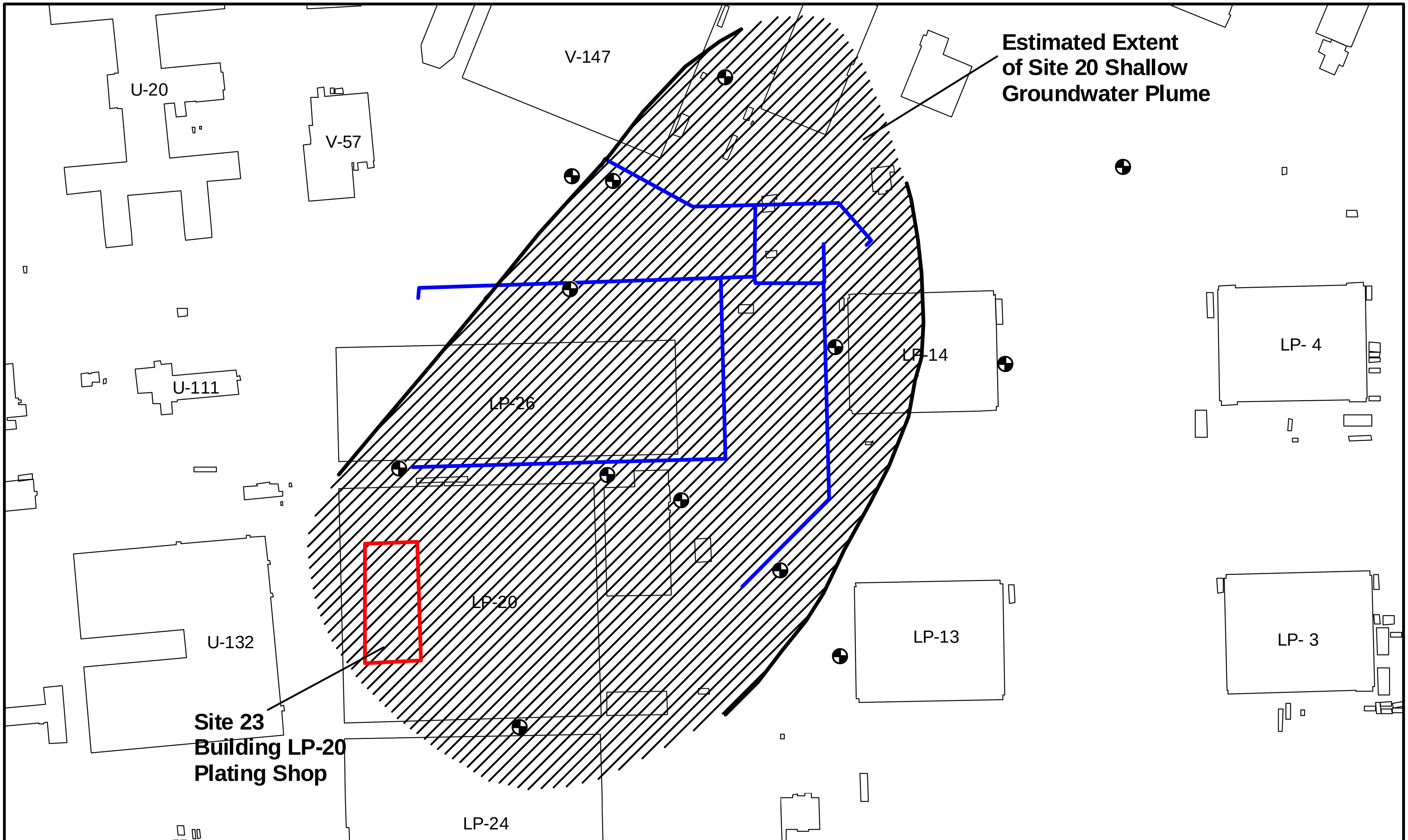


**LEGEND**

Monitoring Well

Approximate Alignments of Air-Sparging and Soil-Vapor Extraction Wells and Piping

Figure 2-1
Site 20 and Site 23 Boundaries
Naval Station Norfolk
Norfolk, Virginia

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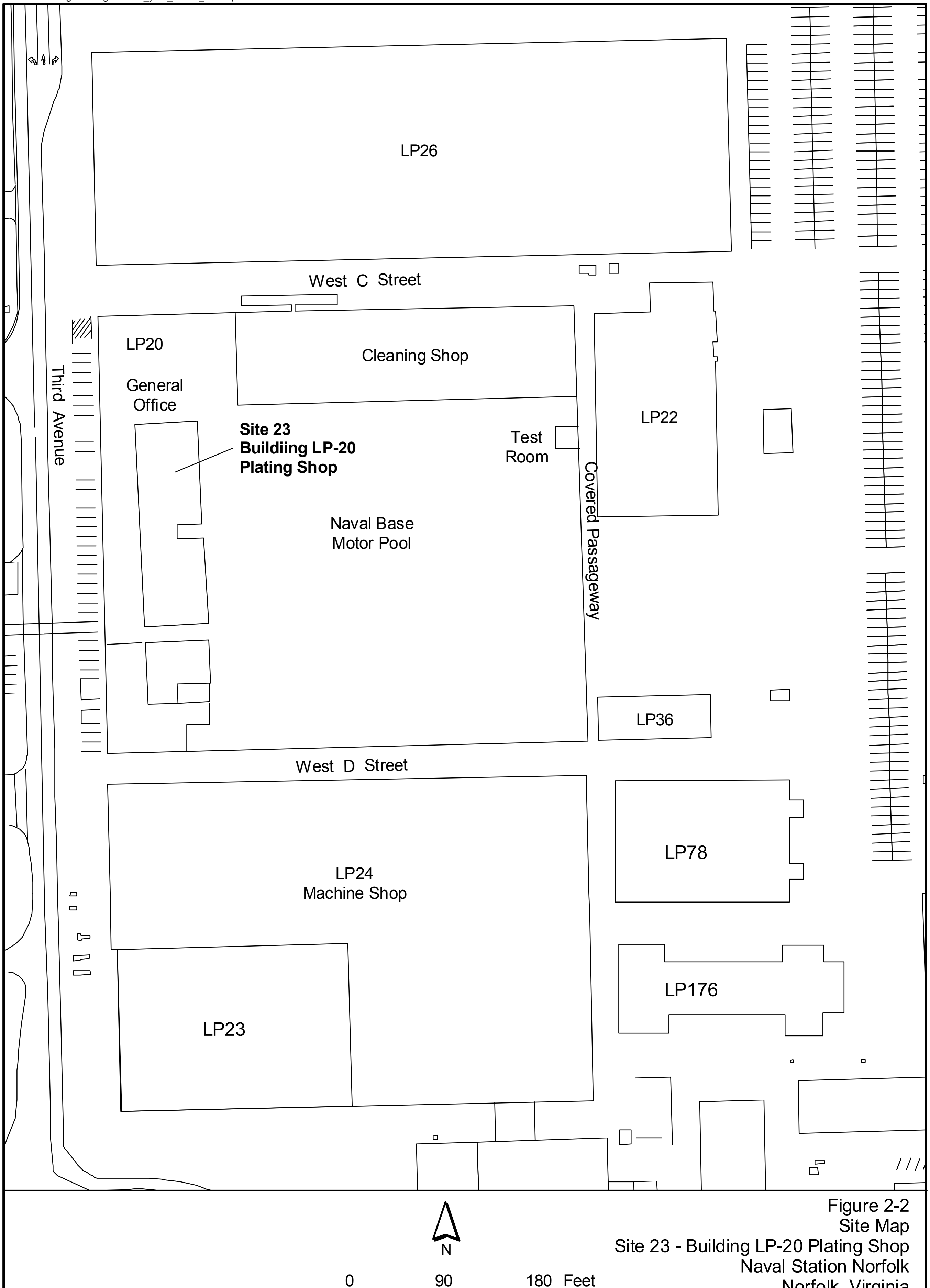


Figure 2-2
Site Map
Site 23 - Building LP-20 Plating Shop
Naval Station Norfolk
Norfolk, Virginia

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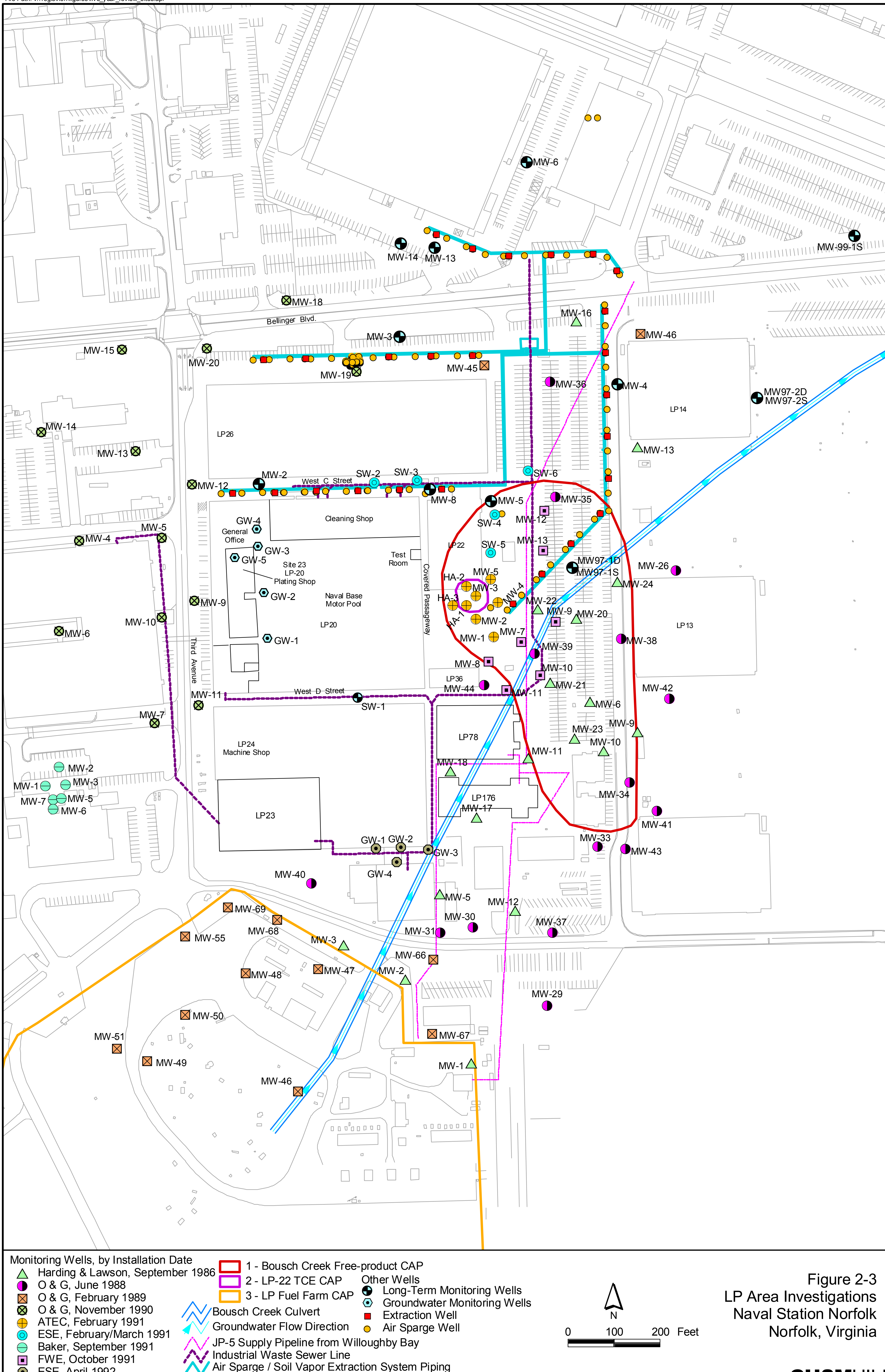


Figure 2-3
LP Area Investigations
Naval Station Norfolk
Norfolk, Virginia

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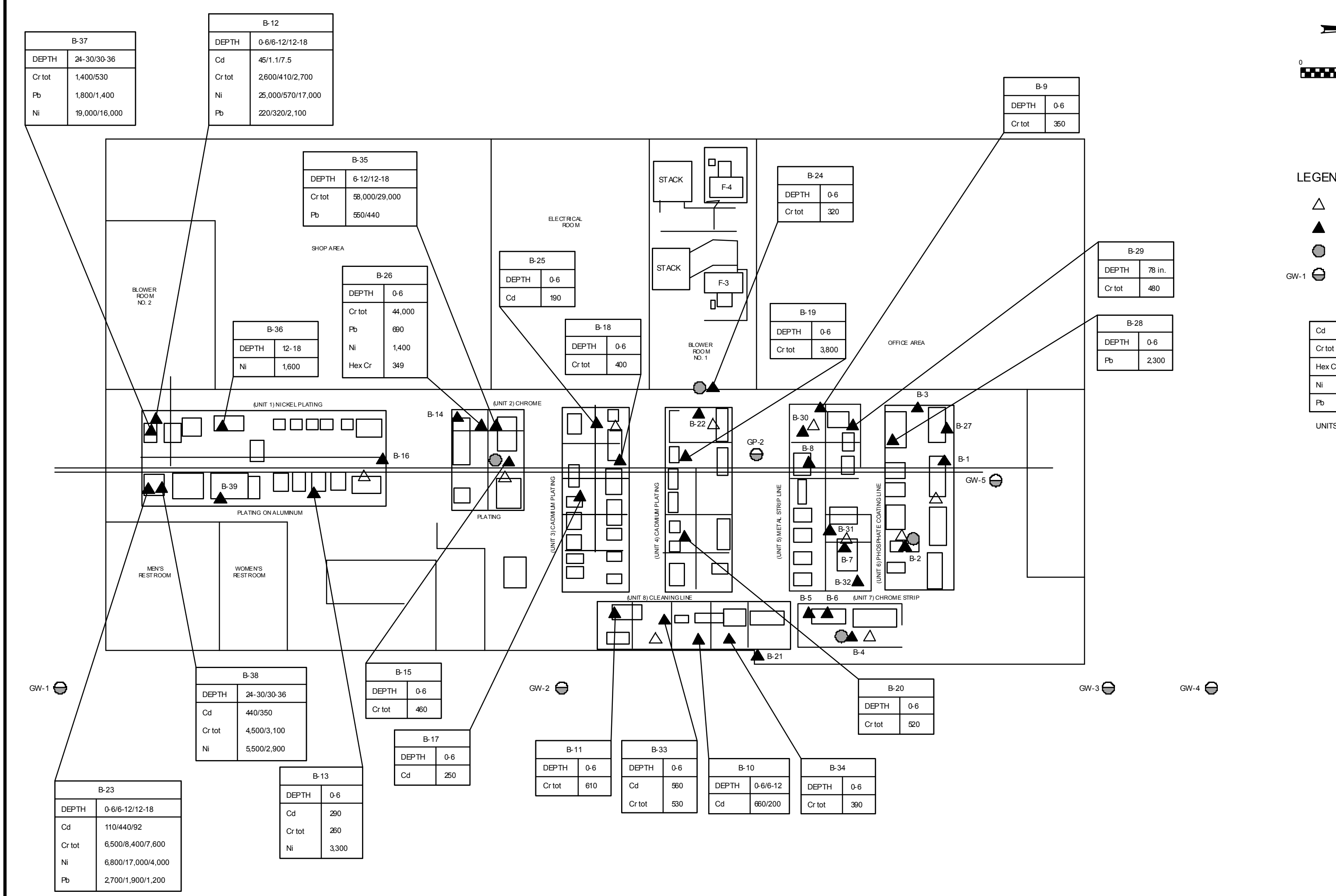


| Chemical constituent | RBCs (mg/kg) |
|---|---|
| Cadium | 78 |
| Chromium (III) | 120,000 |
| Lead | 400 |
| Nickel | 1,600 |
| Hexavalent Chromium | 230 |

Figure 2-4
RCRA Investigation
Sample Locations and Analytical Results
Naval Station Norfolk
Norfolk, Virginia

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SECTION 3

# Sampling Rationale

The rationale for this SI Work Plan is based on the information presented in the RCRA investigation for the LP-20 Plating Shop. The sampling rationale was joint-scoped with the NSN Tier I Partnering Team in January 2004. The groundwater within the area of Building LP-20 was extensively evaluated during the RI conducted at Site 20. Therefore, this phase of the investigation at Site 23 will focus on the site soils. The need to assess the groundwater at Site 23 separately from Site 20 will be evaluated based upon the results of the soil sampling. The objectives of the SI are as follows:

- Further investigate the vertical extent of soil contamination in identified hotspots,
- Determine the nature and extent of soil contamination in the metal plating/processing pits,
- Delineate soil contamination within the Plating Shop areas outside of the pits, and
- Provide a more complete list of analytes; target analyte list (TAL) and target compound list (TCL); compared to the limited analysis conducted during the previous RCRA investigations.

To meet the SI objectives, surface and subsurface soil samples will be collected from Site 23, Building LP-20 Plating Shop. Samples will be collected in three different areas of the plating shop; the hotspots, metal plating/process pits, and outside the process pits. A total of 55 samples will be collected at 26 sample locations (Figure 3-1). The number of samples and sample placement were designed to fill spatial gaps from previous sampling and delineate soil contamination within the plating shop area outside of the pits.

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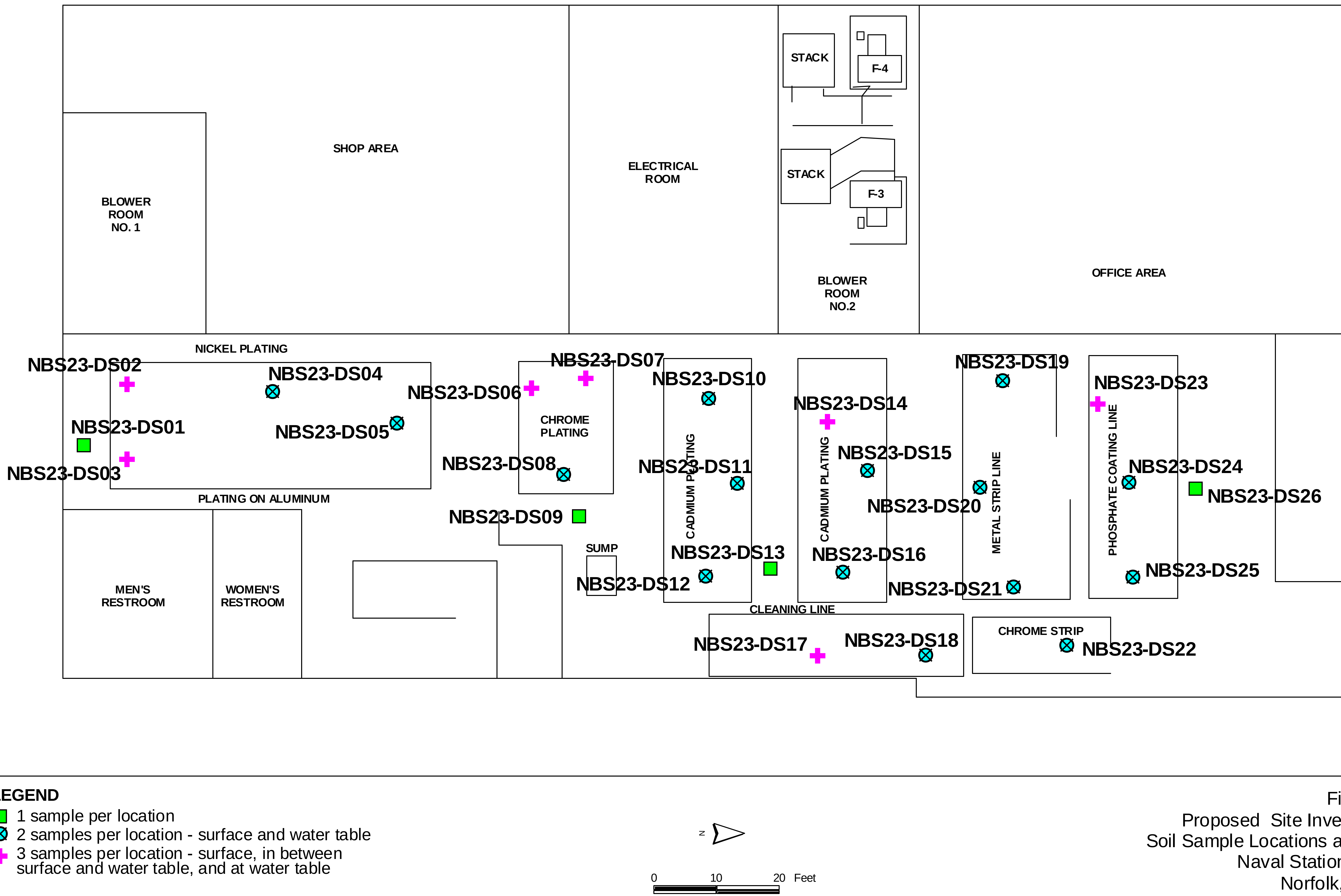


**LEGEND**

- 1 sample per location
- 2 samples per location - surface and water table
- 3 samples per location - surface, in between surface and water table, and at water table

Figure 3-1
Proposed Site Investigation
Soil Sample Locations at Site 23
Naval Station Norfolk
Norfolk, Virginia

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SECTION 4

# Site Investigation Tasks

The purpose of the SI tasks are to further delineate the soil contamination at Site 23 - Building LP-20 Plating Shop. In addition, a qualitative assessment of the human health risk and risk to ecological receptors will be conducted by comparison of the analytical results to screening values.

The tasks to be implemented for the SI include the existing data review, field investigation (sampling and analysis of surface and subsurface soil), sample analysis and data validation, data evaluation, and the preparation of a SI Report. Specific procedures will be addressed in task-specific project instructions.

To simplify the process of developing site-specific project plans, a Master Work Plan, Master Field Sampling Plan (FSP), Master Quality Assurance Project Plan (QAPP), and Master Health and Safety Plan (HASP) have been prepared for NSN (CH2M HILL, 1997). The Master Project Plans provide the details for sampling and analysis protocols to be followed and general types of activities to be accomplished for implementing the field activities at NSN. Preparation of site-specific plans is simplified through reference to the Master Plan documents. Site-specific plans are presented in the form of Standard Operating Procedures (SOPs) presented in the Master Work Plan documents. Table 4-1 lists the applicable SOPs for this WP. These SOPs are provided in Appendix A.

## 4.1 Existing Data Review

This task includes the review of existing data from previous investigations (summarized in Section 2) and verification of their usability. Historical analytical results will be reviewed to assess data validity. Laboratory analytical methods, quantification limits and detection limits, and quality assurance protocols used in previous investigations will be reviewed to ensure appropriate data quality. Historic analytical data that do not meet the appropriate data quality objectives, as measured by the degree of precision, accuracy, representativeness, comparability, and completeness (as defined in the Master QAPP), will not be considered usable, quantitatively, but may be considered in a qualitative manner.

## 4.2 Field Investigation

All field work for the SI at Site 23, Building LP-20 Plating Shop will be performed by Shaw Environmental and Infrastructure, Inc. (Shaw E & I) with oversight provided by CH2M HILL. The field investigation involves efforts related to field work support, the field investigation and sampling events, sample designation, and surveying.

### 4.2.1 Field Work Support

Field work support includes subcontractor procurement, utility clearance, and mobilization and demobilization (see Section 5.2 of the Master Work Plan). Utility clearances and a base dig permit will be obtained prior to the start of any subsurface investigation activities at the site. Shaw E & I will coordinate subsurface utility clearances with NSN. As part of field work support, Shaw E & I will procure concrete coring, a direct push technology (DPT) drilling firm, a laboratory, a third-party, independent validator, and investigation-derived waste (IDW) disposal services for work at Site 23. Equipment and supplies will be brought to the site when the Shaw E & I field team mobilizes for field activities. Demobilization activities will consist of general site restoration prior to the return transport of field equipment and crew.

## 4.2.2 Field Investigation and Sampling Activities

Field investigation activities are discussed in Section 5.3 of the Master Work Plan. Applicable SOPs are listed in Table 4-1. The media sampled, number of samples, sample placement, and analytes proposed for evaluation are based on the results of previous analytical sampling and discussions with the Tier I Partnering Team in January and March 2004. The Team agreed to a phased investigation approach where the soil will be sampled and on evaluation of the data conducted, determine if additional investigations are warranted.

### 4.2.2.1 Site 23 Soil Sampling

To meet the SI objectives, surface and subsurface sample locations will be collected at Site 23, Building LP-20 Plating Shop. Samples will be collected in three different areas: the hotspots, metal plating/process pits, and outside the process pits, but within the Plating Shop. A total of 55 samples will be collected at 26 sample locations (Figure 3-1). The number of samples and sample placement were designed to fill spatial gaps from previous sampling and delineate soil contamination within the plating shop area outside of the pits.

#### Hotspots

Seven hotspot sample locations have been identified within Building LP-20 Plating Shop based upon the previous investigations (Figure 3-1). Surface and subsurface soil will be collected at each location at three depth intervals including surface soil (0-1 ft), water table (approximately 5 ft), and an interval between (approximately 2.5 ft.).

#### Metal Plating/ Process Pits

Co-located surface and subsurface soil samples will be collected from 15 locations within the metal plating/ process pits within Site 23 (Figure 3-1). Soil will be collected at two depth intervals including surface soil (0-1 ft) and just above the water table (approximately 5 ft).

#### Areas Outside the Process Pits

Surface soil will be collected from four locations outside of the process pits within Site 23 (Figure 3-1). Soil samples will be collected at a depth of 0-1 ft below ground surface (bgs).

All soil samples from Site 23, Building LP-20 Plating Shop will be submitted to an off-site laboratory for analysis of target analyte list (TAL) metals, hexavalent chromium, target compound list (TCL) VOCs, and TCL SVOCs. Table 4-2 shows the required containers, preservatives, and holding times for samples as well as the analytical methods (see the QAPP for reporting limits). A sample summary is presented in Table 4-3.

#### 4.2.2.2 Personal Protective Equipment (PPE) and Air Monitoring

Levels of PPE are assigned to each principle activity performed at Site 23. Anticipated PPE levels used during this investigation include Levels D, Modified Level D, and C, in order from the lowest level of protection. The PPE levels and specifications for each site activity are presented in Table 4-4.

Work area air monitoring will be by direct reading methods for soil sampling in the Building LP-20 Plating Shop. Air monitoring results will be used to determine the effectiveness and/or need for dust control methods and to trigger action levels as specified in Table 4-5.

#### 4.2.2.3 Sampling Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use in accordance with applicable SOPs included in Appendix A.

#### 4.2.2.4 Sampling Shipping and Chain-of–Custody (COC)

Sample shipping and chain-of-custody will follow the procedures specified in Section 3.2 of the Master FSP and Section 6 of the Master QAPP.

### 4.2.3 Sample Designation

Sampling locations and sampled media collected during the investigation will be assigned unique designations to allow the sampling information and analytical data to be entered into the Geographic Information System (GIS) Data Management system for NSN. The following sections describe the sample designation specifications (also see Section 3.0 of the Master FSP).

#### 4.2.3.1 Specifications for Field Location Data

Field station data consists of information assigned to a physical location in the field where a sample is collected. For example, a soil boring that has been installed will require a name that will uniquely identify it with respect to other soil boring locations, or other types of sampling locations. The station name provides for a key in the database to which any samples collected from that location can be linked to form a relational database.

A listing of the location identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the station location by facility, site type, site number, location type, and sequential location number. The scheme that will be used to identify the field station data is shown in Table 4-6. Station and sample IDs are provided in Table 4-3. Figure 3-1 presents each station ID with each sample location.

#### 4.2.3.2 Specifications for Analytical Data

Analytical data will be generated for the sampled media (soil) at Site 23. Each analytical sample that is collected will be assigned a unique sample identifier. The scheme used as a guide for labeling analytical samples in the field is documented in Section 4.2.3.3. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is discussed in Section 4.3.3.

#### 4.2.3.3 Sample Identification Scheme

A standardized numbering system will be used to identify all samples collected during sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A listing of the sample identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. Sample identification for all samples collected during the investigations will use the following format.

Each sample will be designated by an alphanumeric code that will identify the facility, site, and matrix sampled, and contains a sequential sample number. QA/QC samples will have a unique sample designation. A summary of the sample identification scheme is presented in Table 4-6.

#### 4.2.3.4 Electronic Deliverable File Format

This effort includes checking the data from the laboratory and converting it into an electronic format that can be readily incorporated into the GIS Data Management system for NSN. An off-site laboratory will analyze the samples and tabulate the results in an electronic format specified by CH2M HILL (Table 4-7). The data validator will add data validation qualifiers to the table of analytical results. In addition to the hard copy data package deliverable, CH2M HILL will receive an electronic file from the data validator in a table format that will facilitate loading into a database (Table 4-8). A summary of the analytical data electronic deliverable format is contained in the Master Data Management Plan. Analytical data must be delivered in Microsoft Excel format.

### 4.2.4 Surveying

The soil sample locations (Figure 3-1) will be surveyed both vertically and horizontally using the Virginia State Plane Coordinate System. The vertical elevations accuracy will be ±0.01 foot, while the horizontal location will have an accuracy of ±0.1 foot. The locations of the soil borings will be determined by a CH2M HILL field scientist.

### 4.2.5 Investigation-Derived Waste (IDW)

IDW generated during field activities will be containerized in 55-gallon drums for storage. These drums will be properly labeled and stored at a location designated by the Navy prior to disposal. The IDW disposal method will be dependent on the characterization from the analytical results.

## 4.3 Sample Handling and Data Validation

CH2M HILL will track sample analysis and obtain results from the laboratory. The analytical data generated during the investigation field program will be validated by an independent data validation subcontractor according to the United States Environmental Protection Agency (USEPA) standard procedures. A detailed discussion of quality control procedures for field investigations at NSN is presented in Section 5.4 of the Master Work Plan.

### 4.3.1 Sample Analysis

All analyses will be conducted at a contracted laboratory that fulfills all requirements of the U.S. Navy's QA/QC Program Manual and USEPA's Contract Laboratory Program (CLP). A signed certificate of analysis will be provided with each laboratory data package, along with a certificate of compliance certifying that all work was performed in accordance with the applicable federal, state, and local regulations. All analyses will be performed following the highest level of Navy guidance. Analyses will include the proper ratio of field QC samples; presented in Table 4-9.

### 4.3.2 Field Quality Control Procedures

Quality control duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and to provide an estimate of the components of variance and the bias in the analytical process. Quality control samples to be collected during the investigation are summarized in Table 4-9.

### 4.3.3 Data Validation

An independent data validation subcontractor will validate all of the analytical data generated during the field programs according to USEPA standard procedures. Analytical results for samples requiring the highest level will be validated by Shaw E & I subcontractors approved by the USEPA and the Navy. Data validators will use USEPA Region III guidance. Data validation subcontractors from the CH2M HILL BOA list will be secured to perform validation services for work at Site 23. Data that should be qualified will be flagged appropriately. Results for QA/QC samples will be reviewed and the data will be qualified further, if necessary. Table 4-10 provides the data validation valid values the selected data validator will follow when sending analytical results to CH2M HILL. Finally, the data set as a whole will be examined for consistency, anomalous results, reasonableness, and utility.

| Table 4-1<br>List of Applicable SOPs From the Master Project Plans<br>Site 23 Work Plan<br>Naval Station Norfolk |
| --- |
| Soil Sampling |
| Soil Boring Drilling and Abandonment |
| Logging of Soil Borings |
| Direct-Push Soil Sample Collection |
| Equipment and Field Rinse Blank Preparation |
| Homogenization of Soil and Sediment Samples |
| Packaging and Shipping Procedures |
| Chain-of-Custody |
| Decontamination of Drilling Rigs and Equipment |
| Decontamination of Personnel and Equipment |

**Table 4-2**
**Analytical Methods and Required Containers, Preservatives, and Holding Times For Samples**
**Site 23 Work Plan**
**Naval Station Norfolk**

**Soil Samples**

| Analysis | Method | Sample Container | Preservative | Holding Time | Volume of Sample |
|---|---|---|---|---|---|
| TCL VOCs | CLP OLM03 | One 4-oz glass bottle with Teflon-lined cap | Cool to 4C | 14 days | Fill completely |
| TCL SVOCs | CLP OLM03 | One 8-oz glass bottle with Teflon-lined cap | Cool to 4C | 14 days | Fill completely |
| TAL Metals/Cyanide | CLP ILM04 | One 4-oz glass bottle with Teflon-lined cap | Cool to 4C | 6 months; 28 days for mercury; 14 days for cyanide | Fill to shoulder |
| Hexavalent Chromium | SW-846 7196A | One 250 mL polyethylene unpreserved bottle | Cool to 4C | 24 hours | Fill completely |

**Table 4-3**
**Sample Summary**
**Site 23 Work Plan**
**Naval Station Norfolk**

| Station Number | Sample ID | Analytes | | | |
|---|---|---|---|---|---|
| | | TCL VOCs | TCL SVOCs | TAL Metals | Hexavalent Chromium |
| NBS23-DS01 | NBS23-DS01-00 | X | X | X | X |
| NBS23-DS02 | NBS23-DS02-00 | X | X | X | X |
| NBS23-DS02 | NBS23-DS02-TBD | X | X | X | X |
| NBS23-DS02 | NBS23-DS02-TBD | X | X | X | X |
| NBS23-DS03 | NBS23-DS03-00 | X | X | X | X |
| NBS23-DS03 | NBS23-DS03-TBD | X | X | X | X |
| NBS23-DS03 | NBS23-DS03-TBD | X | X | X | X |
| NBS23-DS04 | NBS23-DS04-00 | X | X | X | X |
| NBS23-DS04 | NBS23-DS04-TBD | X | X | X | X |
| NBS23-DS05 | NBS23-DS05-00 | X | X | X | X |
| NBS23-DS05 | NBS23-DS05-TBD | X | X | X | X |
| NBS23-DS06 | NBS23-DS06-00 | X | X | X | X |
| NBS23-DS06 | NBS23-DS06-TBD | X | X | X | X |
| NBS23-DS06 | NBS23-DS06-TBD | X | X | X | X |
| NBS23-DS07 | NBS23-DS07-00 | X | X | X | X |
| NBS23-DS07 | NBS23-DS07-TBD | X | X | X | X |
| NBS23-DS07 | NBS23-DS07-TBD | X | X | X | X |
| NBS23-DS08 | NBS23-DS08-00 | X | X | X | X |
| NBS23-DS08 | NBS23-DS08-TBD | X | X | X | X |
| NBS23-DS09 | NBS23-DS09-00 | X | X | X | X |
| NBS23-DS10 | NBS23-DS10-00 | X | X | X | X |
| NBS23-DS10 | NBS23-DS10-TBD | X | X | X | X |
| NBS23-DS11 | NBS23-DS11-00 | X | X | X | X |
| NBS23-DS11 | NBS23-DS11-TBD | X | X | X | X |
| NBS23-DS12 | NBS23-DS12-00 | X | X | X | X |
| NBS23-DS12 | NBS23-DS12-TBD | X | X | X | X |
| NBS23-DS13 | NBS23-DS13-00 | X | X | X | X |
| NBS23-DS14 | NBS23-DS14-00 | X | X | X | X |
| NBS23-DS14 | NBS23-DS14-TBD | X | X | X | X |
| NBS23-DS14 | NBS23-DS14-TBD | X | X | X | X |
| NBS23-DS15 | NBS23-DS15-00 | X | X | X | X |
| NBS23-DS15 | NBS23-DS15-TBD | X | X | X | X |
| NBS23-DS16 | NBS23-DS16-00 | X | X | X | X |
| NBS23-DS16 | NBS23-DS16-TBD | X | X | X | X |
| NBS23-DS17 | NBS23-DS17-00 | X | X | X | X |
| NBS23-DS17 | NBS23-DS17-TBD | X | X | X | X |
| NBS23-DS17 | NBS23-DS17-TBD | X | X | X | X |
| NBS23-DS18 | NBS23-DS18-00 | X | X | X | X |
| NBS23-DS18 | NBS23-DS18-TBD | X | X | X | X |
| NBS23-DS19 | NBS23-DS19-00 | X | X | X | X |
| NBS23-DS19 | NBS23-DS19-TBD | X | X | X | X |

**Table 4-3**
**Sample Summary**
**Site 23 Work Plan**
**Naval Station Norfolk**

| Station Number | Sample ID | Analytes: TCL VOCs | TCL SVOCs | TAL Metals | Hexavalent Chromium |
|---|---|---|---|---|---|
| NBS23-DS20 | NBS23-DS20-00 | X | X | X | X |
| NBS23-DS20 | NBS23-DS20-TBD | X | X | X | X |
| NBS23-DS21 | NBS23-DS21-00 | X | X | X | X |
| NBS23-DS21 | NBS23-DS21-TBD | X | X | X | X |
| NBS23-DS22 | NBS23-DS22-00 | X | X | X | X |
| NBS23-DS22 | NBS23-DS22-TBD | X | X | X | X |
| NBS23-DS23 | NBS23-DS23-00 | X | X | X | X |
| NBS23-DS23 | NBS23-DS23-TBD | X | X | X | X |
| NBS23-DS23 | NBS23-DS23-TBD | X | X | X | X |
| NBS23-DS24 | NBS23-DS24-00 | X | X | X | X |
| NBS23-DS24 | NBS23-DS24-TBD | X | X | X | X |
| NBS23-DS25 | NBS23-DS25-00 | X | X | X | X |
| NBS23-DS25 | NBS23-DS25-TBD | X | X | X | X |
| NBS23-DS26 | NBS23-DS26-00 | X | X | X | X |

Notes:

TBD - to be determined. The depth of the top of the sample interval for subsurface samples will be determined based on the depth to the water table.

**Table 4.4**
**Anticipated Protection Levels**
**Site 23 Work Plan**
**Naval Station Norfolk**

| Task | Initial PPE Level | Upgrade PPE Level | Skin Protection | Respiratory Protection | Other PPE |
|---|---|---|---|---|---|
| Mobe/De-mobe; Grout/Concrete Replacement | Level D | Modified Level D | Leather-work gloves. Nitrile gloves are required during the concrete replacement activities. Tyvek® coveralls, as necessary to protect from dust and debris | None | Hard-hat, steel-toe work boots, safety glasses and hearing protection >85 dBA. Goggles/face shield when in contact with liquid contamination or flying debris. |
| Geoprobe® Sampling | Level C | Not Anticipated | Tyvek® coverall, inner latex sample gloves, outer nitrile gloves, latex over boots | Full-face air purifying respirator with 1053 cartridges | Hard-hat, steel-toe work boots, safety glasses and hearing protection >85 dBA. |
| Equipment Decontamination | Modified Level D | Not Anticipated | PVC rain suit or poly-coated Tyvek® coverall, inner latex sample gloves, outer nitrile gloves, latex boot covers, goggles/ face shield when in contact with liquid contamination. | None | Hard-hat, steel-toe work boots and hearing protection >85 dBA. Metatarsal and shin guards are required when operating a pressure washer. |
| General Support Zone Activities | Level D | Not Anticipated | None | None | Hard-hat, steel-toe boots, safety glasses and hearing protection >85dBA. |

## Table 4-5
## Direct Reading Air Monitoring Requirements
## Site 23 Work Plan
## Naval Station Norfolk

| Monitoring Device | Monitoring Location/ Personnel | Monitoring Frequency | Action Level | Action |
|---|---|---|---|---|
| Data RAM | Work area/ During all sampling activities | Continuously during sampling activities | <0.11 mg/m$^{3}$*(1)<br><br>>0.11 – 11.0 mg/m$^{3}$*<br><br>>11.00 mg/m$^{3}$* | Dust control<br><br>Level C<br><br>Stop work. Evaluate dust control measures. Contact the Health and Safety Manager. |
| FID | Breathing Zone/Drillers and Recovery Technician (RT) | Continuously during sampling activities | < 0.5 ppm*<br><br>>0.5ppm*<br><br>2.0 - 20 ppm* with no Benzene or VC<br><br>>20 ppm* | Modified Level D<br><br>Test for benzene and VC<br><br>Level C<br><br>Stop work and re-evaluate. Contact Health and Safety Manager |
| Vinyl Chloride Colorimetric Tubes | Breathing Zone/Drillers and Recovery Technician (RT) | Sustained FID readings of 0.5 ppm | <1.0 ppm*<br><br>1.0-10.0*<br><br>>10.0 ppm* | Modified Level D<br><br>Level C<br><br>Stop work and re-evaluate. Contact Health and Safety Manager |
| Benzene Colorimetric Tubes | Breathing Zone/Drillers and Recovery Technician (RT) | Sustained FID readings of 0.5 ppm | <0.5*<br><br>0.5-5.0 ppm*<br><br>>5.0 ppm* | Modified Level D<br><br>Level C<br><br>Stop work and re-evaluate. Contact Health and Safety Manager |
| Carbon Monoxide<br><br>(CO) | Work area/ All personnel in work area | When internal combustion<br><br>engines are operating in enclosed areas | > 25 ppm* | Stop work and CO sources. Ventilate area. |
| | | | | |

* Sustained levels above background for 5 minutes in the breathing zone.

(1) The 0.11 mg/m$^{3}$ was calculated using the Safety Now computer program. The program calculated the potential for airborne contaminants with nuisance dust based on soil sample results for lead, hexavalent chromium, cadmium, and nickel.

**Table 4-6**
**Sample Designation Schema**
**Site 23 Work Plan**
**Naval Station Norfolk**

| First Segment | Second Segment | | Third Segment |
|---|---|---|---|
| Facility, Station, and Site Number | Sample Type | Sample Location + Sample Qualifier | Additional Qualifiers (sample depth, sampling round, etc.) |
| AAANN | AA | NNNA or NNAA | ANN or NNNN |

Notes: "A"= alphabetic "N"= numeric

<table>
<tr>
<td>Facility:<br>NB = Norfolk Naval Base<br><br>Station Type:<br>S = Site<br><br>Site Number:<br>23 = Site 23</td>
<td>Sample Type:<br>DS = Soil Boring<br>TB = Trip Blank<br>EB = Equipment Blank<br>FB = Field Blank<br><br>Sample Location:<br>1. QC Samples (NNN)<br><br>NNN – numbered sequentially for each type of blank (i.e., 1, 2, etc.) collected for that day's sampling<br><br>NNN - refers to month of sampling event<br><br>Sample Qualifiers:<br>P = duplicate sample</td>
<td>Additional Qualifiers:<br>1. Soil Boring Sample (refers to depth of sample):<br><br>Enter depth of top of sample interval<br><br>3. QC Samples<br><br>NNNN - refers to day and year of sampling event</td>
</tr>
</table>

**Table 4-7**
**Laboratory Valid Values**
**Site 23 Work Plan**
**Naval Station Norfolk**

| SAMPLE ANALYSIS GROUP (EDD "Analysis_Group" Field) (referenced in EnDat's tblLabResult.strAnalysisGroup field) | |
|---|---|
| ASBESTOS | Asbestos |
| AVSSEM | Acid Volatile Sulfide/Simultaneously Extractable Metals |
| CEC | Cation Exchange Capacity |
| CORR | Corrosivity |
| DIOXIN | Dioxins |
| EXPLO | Explosives |
| FDIOX | Filtered or Dissolved Dioxins |
| FMETAL | Filtered or Dissolved Metals |
| FPEST/PCB | Filtered or Dissolved Pesticides/PCBs |
| FWCHEM | Filtered Wet Chemistry (also used for filtered trace metals) |
| HERB | Herbicides |
| IGN | Ignitability |
| METAL | Metals and/or Cyanide |
| PCBCONG | Polychlorinated Biphenyl (PCB) Congeners |
| PEST/PCB | Pesticides and/or Polychlorinated Biphenyls (PCBs) |
| RAD | Radiation |
| REACT | Reactivity (includes reactive sulfide and reactive cyanide) |
| SVOA | Semivolatile Organic Compounds, Base Neutral/Acid (BNA) [includes Poly-Aromatic Hydrocarbons (PAHs)] |
| TCLPH | Herbicide results from the leaching procedure |
| TCLPM | Metal results from the leaching procedure |
| TCLPP | Pesticide and PCB results from the leaching procedure |
| TCLPS | Semivolatile results from the leaching procedure |
| TCLPV | Volatile results from the leaching procedure |
| TPH | TPH (includes DRO and GRO *or* fuel oil, mineral oil, etc.) |
| VOA | Volatile Organic Compounds |
| WCHEM | Ions, Cations, pH, TOC, BOD, TSS, oil & grease, etc. |

| LABORATORY QUALIFIERS (EDD "Lab_Qual" Field) (referenced in EnDat's tblLabResult.strTempLabQualifiers field) | |
|---|---|
| * (metals) | Lab duplicate analysis was not within control limits |
| + (metals) | Correlation coefficient <0.995 |
| B (all others) | Possible blank contamination |
| B (metals) | Below detection limit |
| C (all) | Laboratory comment |
| D (all) | Diluted result |
| E (metals) | Estimated concentration due to interference |
| E (all others) | Concentration has exceeded the calibration range |
| J (organic) | Below detection limit |
| M (metals) | Duplicate injection precision was not met |
| N (metals) | Spiked sample recovery was not within control limits |
| P (pest/p) | Difference between the concentration on the two columns is greater than 20% |
| S (metals) | Concentration determined by Method of Standard Additions (optional) |
| U (all) | Not detected above the detection limit |
| W (metals) | Post-digestion spike outside limits and sample absorbance <50% spike absorbance |

| ReRun (EDD "ReRun" Field) (referenced in EnDat's tblluReRun.strReRun field) | |
|---|---|
| DL | Dilution |
| DL2 | Second Dilution |
| RA | Re-analysis |
| RA2 | Second Re-analysis |
| RE | Re-extractions |
| RE2 | Second Re-extraction |
| REDL | Re-extracted and Diluted sample |
| RE2DL | Re-extracted a second time and Diluted |
| REDL2 | Re-extracted and Diluted a second time |
| | Leave blank if not a multiple run |

| LABORATORY RESULT TYPE (EDD "Result_Type" Field) (referenced in EnDat's tblluResultType.strResultType field) | |
|---|---|
| IS | Internal standard, will be reported as % Recovery |
| S-I | Surrogate or Internal Standard, will be reported as % Recovery |
| SURR | Surrogate, will be reported as % Recovery |
| | Leave blank if neither a surrogate or internal standard |

| LABORATORY QC TYPE (EDD "Lab_QC_Type" Field) (referenced in EnDat's tblSample.strMatrixSpike field) | |
|---|---|
| CCV | Continuing calibration verification (optional) |
| LBLK | Laboratory blank (method, prep, holding, continuing calibration blanks) |
| LCS | Laboratory control sample, will be reported as % Recovery |
| LDUP | Laboratory Duplicate |
| MS | Matrix Spike (includes inorganic spike), will be reported as % Recovery |
| MSD | Matrix Spike Duplicate (includes inorganic duplicate), will be reported as % Recovery |
| SDL | Serial dilution (optional) |
| | Leave blank if not a laboratory QC result |

**Table 4-8**
**CH2M HILL Electronic Data Deliverable Format**
**Site 23 Work Plan**
**Naval Station Norfolk**

| Field Name | Field Format | Req'd | Description |
|---|---|---|---|
| Sample_ID | A25 | R | CH2M HILL sample ID (taken from the chain of custody). |
| Analysis_Group * | A9 | R | The CH2M HILL code for the analysis performed on the sample. |
| DateTime_Collected | 00/00/0000 00:00:00 | R | The date the sample was collected (from the chain of custody). Use 24-hour clock |
| Date_Received | 00/00/0000 | R | The date the sample was received in the lab. |
| Date_Extracted | 00/00/0000 | RA | Extraction or preparation date. |
| Date_Analyzed | 00/00/0000 | R | The date the sample was analyzed. |
| Lab_Sample_ID | A15 | R | The laboratory sample ID. |
| Dilution_Factor | N5 | R | The dilution factor used. Use 1 if not diluted. |
| SDG_Number | A15 | R | Laboratory code for the group of samples in a data deliverable package. |
| Chem_Code | A12 | R | The ERPIMS parameter code. |
| Chem_Name * | A45 | R | The compound being analyzed. |
| CAS_Number * | A6-A2-A1 | R | CAS Number (Note dashes). |
| Ana_Value | N11 | R | The analytical result. It should match the number of significant digits on the hard copy. Use detection limit when not detected. |
| Lab_Qual * | A5 | RA | The lab qualifiers, if any (e.g., U, UJ, B); there may be a qualifier not on the valid value table in special cases. |
| DV_Qual | A5 | | Left blank for data validation qualifiers. |
| DV_Qual_Code* | A5 | | Left blank for data validation qualifier codes. Use valid values. |
| Units * | A15 | R | The unit of the result (e.g., mg/L). |
| Detect_Limit | N5 | R | The minimum available sample-specific detection limit for the compound, the laboratory reporting limit. |
| MDL | N10,3 | R | Method detection limit. |
| Preparation | A15 | R | ERPIMS code used for the preparation method of the sample fraction. |
| Analysis_Method | A15 | R | Analytical method used to analyze the sample fraction. Use ERPIMS codes. |
| Result_Type * | A15 | RA | The laboratory QC type for single compounds (e.g, SURR, IS) All surrogates and internal standard results are to be reported in % recovery units. |
| Lab_QC_Type * | A15 | RA | Laboratory samples (lab blanks, dups, LCS, etc.). |
| PCT_Moisture | N3,3 | RA | Percent moisture for soil samples; not applicable for aqueous samples. |
| Basis | A3 | RA | Concentrations are reported on a wet or dry weight basis. Use ERPIMS codes. |
| Batch | A12 | R | Laboratory code for the batch of samples analyzed together. |
| Lab_Code | A10 | R | The ERPIMS code for the name of the laboratory. |
| ReRun* | A9 | RA | To report dilutions, re-extractions, and/or re-analyses. |
| QC_Limits | AAA-AAA | RA | Laboratory QC limits in percent recovery for surrogates, internal standards, laboratory control spikes, calibration checks, interference check standards, serial dilutions, and MS/MSDs. |
| Comment | A 30 | RA | For the laboratory to note exceptions. |

Notes:
* - See valid value list
TICs are not reported on the EDD
R - Required field
NR - Not Required
RA - Required as Appropriate
EDD may be submitted in ASCII (comma delimited) or in Excel

| Table 4-9<br>General Requirements For QC Sample Collection<br>Site 23 Work Plan<br>Naval Station Norfolk | |
|---|---|
| **QC Samples** | **QC Specified Collection Frequency** |
| Field Duplicate | One per 10 samples per matrix or one duplicate per day, matrix, and site, whichever is more frequent |
| Trip Blank | One per cooler containing samples collected for VOC analysis |
| Equipment (Rinsate) Blank | One per day per matrix per site |
| Field Blank | One per site per sampling event |
| Temperature Blank | One per cooler |
| Matrix Spike/Matrix Spike Duplicate | One per matrix for each group of up to 20 samples sent to a single laboratory |

**Table 4-10**
**Data Validation Valid Values**
**Site 23 Work Plan**
**Naval Station Norfolk**

| Data Validation Qualifiers (EDD "DV_Qual" Field) (referenced in EnDat's tblLabResult.strAnalysisGroup field) | |
|---|---|
| U | Not Detected |
| | Confirmed Identification |
| B | Not detected substantially above the level reported in laboratory or field blanks |
| R | Unreliable result |
| N | Tentative Identification. Consider Present. Special methods may be needed to confirm its presence or absence in future sampling efforts |
| J | Analyte present. Reported value may or may not be accurate or precise |
| K | Analyte present. Reported value may be biased high. Actual value is expected to be lower |
| L | Analyte present. Reported value may be biased low. Actual value is expected to be higher |
| UJ | Not detected, quantitation limit may be inaccurate or imprecise |
| UL | Not detected, quantitation limit is probably higher |
| Q | No Analytical Result |
| NJ | Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity |
| I | Interferences present which may cause the results to be biased high |

| Data Validation Qualifier Codes (EDD "Qual_Code" Field) (referenced in EnDat's tblLabResult.strDVQualCode field) | |
|---|---|
| TN | Tune |
| BSL | Blank Spike/LCS – Low Recovery |
| BSH | Blank Spike/LCS – High Recovery |
| BD | Blank Spike/Blank Spike Duplicate(LCS/LCSD) Precision |
| BRL | Below Reporting Limit |
| ISL | Internal Standard – Low Recovery |
| ISH | Internal Standard – High Recovery |
| MSL | Matrix Spike and/or Matrix Spike Duplicate – Low Recovery |
| MSH | Matrix Spike and/or Matrix Spike Duplicate – High Recovery |
| MI | Matrix interference obscuring the raw data |
| MDP | Matrix Spike/Matrix Spike Duplicate Precision |
| 2S | Second Source – Bad reproducibility between tandem detectors |
| SSL | Spiked Surrogate – Low Recovery |
| SSH | Spiked Surrogate – High Recovery |
| SD | Serial Dilution Reproducibility |
| ICL | Initial Calibration – Low Relative Response Factors |
| ICH | Initial Calibration – High Relative Response Factors |
| ICB | Initial Calibration – Bad Linearity or Curve Function |
| CCL | Continuing Calibration Verification – Low Recovery |
| CCH | Continuing Calibration Verification – High Recovery |
| CC | Continuing Calibration |
| LD | Lab Duplicate Reproducibility |
| HT | Holding Time |
| PD | Pesticide Degradation |
| 2C | Second Column – Poor Dual Column Reproducibility |
| LR | Concentration Exceeds Linear Range |
| BL | Blank Contamination |
| RE | Redundant Result - due to Reanalysis or Re-extraction |
| DL | Redundant Result – due to Dilution |
| FD | Field Duplicate |
| OT | Other |

SECTION 5
# Staff Organization

This project will be managed and staffed by CH2M HILL's Virginia Beach office. The CH2M HILL Activity Manager, Ms. Holly Rosnick, will assume primary responsibility for ensuring that the work is performed in a manner that is acceptable to Naval Facilities Engineering Command (NAVFAC), the Base, and government regulatory agencies. In addition, Mr. Ben Francisco will serve as the CH2M HILL project manager. The field work will be performed by Shaw E & I personnel with oversight provided by CH2M HILL. Mr. Taylor Sword will serve as the Shaw E & I project manager. Table 5-1 provides contact information for the participants in this Work Plan.

**Table 5-1**
**Contact Information**
**Site 23 Work Plan**
**Naval Station Norfolk**

| Name | Title | Organization | Phone Number |
|---|---|---|---|
| Winoma Johnson | Remedial Project Manager | NAVFAC | 757-322-4587 |
| Channing Blackwell | IR Program Manager | CNRMA | 757-887-4086 |
| Holly Rosnick | Activity Manager | CH2M HILL | 703-471-6405 x4346 |
| Ben Francisco | Project Manager | CH2M HILL | 757-460-3734 ext. 20<br>mobile - 757-617-5045 |
| Taylor Sword | Project Manager | Shaw E & I | 757-318-5142<br>mobile - 757-672-4528 |

SECTION 6

# Estimated Project Schedule

The project schedule and due dates of deliverables will be defined by Shaw E & I. Schedules will be coordinated with CH2M HILL and NAVFAC.

SECTION 7
# References


Baker Environmental, Inc. *Draft Final Remedial Investigation Report and Baseline Risk Assessment, Building LP-20 Site, Naval Base, Norfolk, Virginia.* December 1995.

CH2M HILL. *Final Master Work Plan, Naval Base Norfolk, Norfolk, Virginia*. October 1997.

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Norfolk Naval Base. Clean Closure Plan (Building LP-20). February 1993.

O'Brien and Gere*. Building LP-20 RCRA Closure Report. NADEP Naval Air Station Norfolk.* December 1997.

Versar, Inc. *Risk-Based Closure Plan Metal Plating Shop Building LP-20 Naval Base Norfolk, Virginia.* December 1997.

Versar, Inc. *Closure Plan for RCRA Closure of Hazardous Waste Storage Facility Building LP-20 Plating Shop Norfolk Naval Base, Norfolk, Virginia.* September 2000.

Versar, Inc. *Contingent Closure Plan Closure in Place and Post-Closure Care RCRA Closure of Hazardous Waste Storage Facility Building LP-20 Plating Shop Norfolk Naval Base, Norfolk, Virginia.* September 2000.

# Appendix A
# Standard Operating Procedures

# Soil Sampling

## I. Purpose and Scope

The purpose of this procedure is to provide guidelines for obtaining samples of surface and subsurface soils using hand and drilling-rig mounted equipment.

## II. Equipment and Materials

- Stainless-steel trowel, shovel, scoopula, coring device, trier, hand auger, or other appropriate hand tool
- Stainless-steel, split-spoon samplers
- Drilling rig or soil-coring rig
- Stainless-steel pan or bowl
- Sample bottles

## III. Procedures and Guidelines

Before sampling begins, equipment will be decontaminated using the procedures described in SOP Deconrig (Decontamination of Drilling Rigs and Equipment). The sampling point is located and recorded in the field logbook. Debris should be cleared from the sampling location.

### A. Surface and Shallow Subsurface Sampling

A shovel, post-hole digger, or other tool can be used to remove soil to a point just above the interval to be sampled. A decontaminated sampling tool will be used to collect the sample when the desired sampling depth has been reached. Soil for semivolatile organic and inorganic analyses is placed in the bowl and mixed; soil for volatile organic analysis is not mixed or composited but is placed directly into the appropriate sample bottles. A stainless-steel or dedicated wooden tongue depressor is used to transfer the sample from the bowl to the container.

The soils removed from the borehole should be visually described in the field log book, including approximated depths.

When sampling is completed, photo-ionization device (PID) readings should be taken directly above the hole, and the hole is then backfilled.

### B. Split-Spoon Sampling

Using a drilling rig, a hole is advanced to the desired depth. For split-spoon sampling, the samples are then collected following the ASTM D 1586 standard (attached). The sampler is lowered into the hole and driven to a depth equal to the total length of the sampler; typically this is 24 inches. The sampler is driven in 6-inch increments using a 140-pound weight ("hammer") dropped from a height of 30 inches. The number of hammer blows for each 6-inch interval is counted and recorded. To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch ID sampler may be required. Blow counts obtained with a 3-inch ID spoon would not conform to ASTM D 1586 and would therefore not be used for geotechnical evaluations.

Once retrieved from the hole, the sampler is carefully split open. Care should be taken not to allow material in the sampler to fall out of the open end of the sampler. To collect the sample, the surface of the sample should be removed with a clean tool and disposed of. Samples collected for volatiles analysis should be placed directly into the sample containers from the desired depth in the split spoon. Material for samples for all other parameters should be removed to a decontaminated stainless steel tray. The sample for semivolatile organic and inorganic analyses should be homogenized in the field by breaking the sample into small pieces and removing gravel. The homogenized sample should be placed in the sample containers. If sample volume requirements are not met by a single sample collection, additional sample volume may be obtained by collecting a sample from below the sample and compositing the sample for non-volatile parameters only.

Split-spoon samples also will be collected using a tripod rig. When using a tripod rig the soil samples are collected using an assembly similar to that used by the drilling rig.

## IV. Attachments

ASTM D 1586.

## V. Key Checks and Preventative Maintenance

Check that decontamination of equipment is thorough. Check that sample collection is swift to avoid loss of volatile organics during sampling.

STANDARD OPERATING PROCEDURE

# Soil Boring Drilling and Abandonment

## I. Purpose and Scope

The purpose of this guideline is to describe methods to obtain samples of subsurface soil and then backfill boreholes to the surface.

## II. Equipment and Materials

- Truck-mounted drilling rig, and a skid rig or barge-mounted tripod rig
- Hollow-stem augers (4¼-inch ID)
- Split-spoon samplers
- Downhole compacting tool (e.g., a pipe with a flat plate attached to the bottom)
- Cement
- Bentonite
- Hand augers, stainless steel

## III. Procedures and Guidelines

Before sampling begins, equipment will be decontaminated according to the procedures identified in SOP Decontamination of Personnel and Equipment. The location to be sampled is cleared of debris and trash, and the location is noted in the logbook.

Continuous-fight hollow-stem augers with an inside diameter of at least 4.25 inches are used. The use of water or other fluid to assist in hollow-stem drilling will be avoided.

The bit of the auger is placed on the ground at the location to be drilled and then turned with the drilling or soil-coring rig. For split-spoon sampling, the auger is advanced to a depth just above the top of the interval to be sampled.

While advancing the augers to the full borehole depth, the soils removed from the boring will be screened using a portable volatile organics detector. The borehole will be grouted to the surface with bentonite-cement grout. The soil cuttings are to be drummed and managed as described in SOP Disposal of Waste Fluids and Soils.

The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface. When installing grout in soil borings, the grout will be installed through a tremie pipe that is placed inside the augers. The grouting will be completed before the augers are removed.

Samples will be collected from the soil borings at 2-foot intervals. The soil samples will be collected from the surface continuously to the water table. Because some of the soil samples are being collected for chemical analysis, decontaminated stainless steel split-spoon samplers will be used for sample collection. The split-spoon samplers will be decontaminated according to the procedures outlined in SOP Decontamination of Personnel and Equipment. Sample collection will follow the general procedures outlined in SOP Soil Boring Sampling–Split Spoon.

A tripod drilling rig or skid rig will be required for boring installation in the lagoons. A tripod drilling rig is generally a tripod equipped to collect continuous samples using a hammer-driven sampler. The soil sample collection will be the same as that outlined above, except that hollow-stem augers are not used to advance the borehole. Borehole collapse due to soft sediments may occur when collecting samples using a tripod drilling rig.

Soil samples will be collected at 1-foot intervals. The soil samples will be placed in clean jars and a headspace measurement of the volatile organics in each of the samples determined. The headspace measurements will be used to identify the potentially most-contaminated samples which will be submitted for analysis through the CLP.

## IV. Attachments

None.

## V. Key Checks and Preventative Maintenance

Check that the drilling rig or soil-coring rig is in working order. Check that the borehole is grouted to the ground surface at the completion of drilling and sampling.

# Logging of Soil Borings

## I. Purpose and Scope

This SOP provides guidance to obtain accurate and consistent descriptions of soil characteristics during soil-sampling operations. The characterization is based on visual examination and manual tests, not on laboratory determinations.

## II. Equipment and Materials

- Indelible pens
- Tape measure or ruler
- Field logbook
- Spatula
- HCl, 10 percent solution
- Squirt bottle with water
- Rock- or soil-color chart
- Grain-size chart
- Hand lens
- Unified Soil Classification System (USCS) index charts and tables to help with soil classification

## III. Procedures and Guidelines

This section covers several aspects of the soil characterization: instructions for completing the CH2M HILL soil boring log Form D1586, field classification of soil, and standard penetration test procedures.

### A. Instructions for Completing Soil Boring Logs

Soil boring logs will be completed in the field log books. Information collected will be consistent with that required for Form D1586 (attached), a standard CH2M HILL form or an equivalent form that supplies the same information.

The information collected in the field to perform the soil characterization is described below.

Field personnel should review completed logs for accuracy, clarity, and thoroughness of detail. Samples also should be checked to see that information is correctly recorded on both jar lids and labels and on the log sheets.

## B. Heading Information

**Boring/Well Number.** Enter the boring/well number. A numbering system should be chosen that does not conflict with information recorded for previous exploratory work done at the site. Number the sheets consecutively for each boring.

**Location.** If stationing, coordinates, mileposts, or similar project layout information is available, indicate the position of the boring to that system using modifiers such as "approximate" or "estimated" as appropriate.

**Elevation.** Elevation will be determined at the conclusion of field activities.

**Drilling Contractor.** Enter the name of the drilling company and the city and state where the company is based.

**Drilling Method and Equipment.** Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger). Information on the drilling equipment (e.g., CME 55, Mobile B61) also is noted.

**Water Level and Date.** Enter the depth below ground surface to the apparent water level in the borehole. The information should be recorded as a comment. If free water is not encountered during drilling or cannot be detected because of the drilling method, this information should be noted. Record date and time of day (for tides, river stage) of each water level measurement.

**Date of Start and Finish.** Enter the dates the boring was begun and completed. Time of day should be added if several borings are performed on the same day.

**Logger.** Enter the first initial and full last name.

## C. Technical Data

**Depth Below Surface.** Use a depth scale that is appropriate for the sample spacing and for the complexity of subsurface conditions.

**Sample Interval.** Note the depth at the top and bottom of the sample interval.

**Sample Type and Number.** Enter the sample type and number. SS-1 = split spoon, first sample. Number samples consecutively regardless of type. Enter a sample number even if no material was recovered in the sampler.

**Sample Recovery.** Enter the length to the nearest 0.1 foot of soil sample recovered from the sampler. Often, there will be some wash or caved material above the sample; do not include the wash material in the measurement. Record recovery in feet.

**Standard Penetration Test Results.** In this column, enter the number of blows required for each 6 inches of sampler penetration and the "N" value, which is the sum of the blows in the middle two 6-inch penetration intervals. A typical standard penetration test involving successive blow counts of 2, 3, 4, and 5 is recorded as 2-3-4-5 and (7). The standard penetration test is terminated if the sampler encounters refusal. Refusal is a penetration of less than 6 inches with a blow count of 50. A partial penetration of 50 blows for 4 inches is recorded as 50/4 inches. Penetration by the weight of the slide hammer only is recorded as "WOH."

Samples should be collected using a 140-pound hammer and 2-inch diameter split spoons.

Sample also may be collected using a 300-pound hammer or 3-inch-diameter split-spoon samples at the site. However, use of either of these sample collection devices invalidates standard penetration test results and should be noted in the comments section of the log. The 300-pound hammer should only be used for collection of 3-inch-diameter split-spoon samples. Blow counts should be recorded for collection of samples using either a 3-inch split-spoon, or a 300-pound hammer. An "N" value need not be calculated.

**Soil Description.** The soil classification should follow the format described in the "Field Classification of Soil" subsection below. `

**Comments.** Include all pertinent observations (changes in drilling fluid color, rod drops, drilling chatter, rod bounce as in driving on a cobble, damaged Shelby tubes, and equipment malfunctions). In addition, note if casing was used, the sizes and depths installed, and if drilling fluid was added or changed. You should instruct the driller to alert you to any significant changes in drilling (changes in material, occurrence of boulders, and loss of drilling fluid). Such information should be attributed to the driller and recorded in this column.

Specific information might include the following:

- The date and the time drilling began and ended each day
- The depth and size of casing and the method of installation
- The date, time, and depth of water level measurements
- Depth of rod chatter
- Depth and percentage of drilling fluid loss
- Depth of hole caving or heaving
- Depth of change in material
- Health and safety monitoring data
- Drilling interval through a boulder

## D. Field Classification of Soil

This section presents the format for the field classification of soil. In general, the approach and format for classifying soils should conform to ASTM D 2488-93, Visual-Manual Procedure for Description and Identification of Soils.

The Unified Soil Classification System is based on numerical values of certain soil properties that are measured by laboratory tests (ASTM D 2487). It is possible, however, to estimate these values in the field with reasonable accuracy using visual-manual procedures (ASTM D 2488-93, attached). In addition, some elements of a complete soil description, such as the presence of cobbles or boulders, changes in strata, and the relative proportions of soil types in a bedded deposit, can be obtained only in the field.

Soil descriptions should be precise and comprehensive without being verbose. The correct overall impression of the soil should not be distorted by excessive emphasis on insignificant details. In general, similarities rather than differences between consecutive samples should be stressed.

Soil descriptions must be recorded for every soil sample collected. The format and order for soil descriptions should be as follows:

1. Soil name (synonymous with ASTM D 2488-93 Group Name) with appropriate modifiers. Soil name should be in all capitals in the log, for example "POORLY-GRADED SAND."
2. Group symbol, in parentheses, for example, "(SP)."
3. Color, using Munsell color designation
4. Moisture content
5. Relative density or consistency
6. Soil structure, mineralogy, or other descriptors

This order follows, in general, the format described in ASTM D 2488-93.

## E. Soil Name

The basic name of a soil should be the ASTM D 2488-93 Group Name on the basis of visual estimates of gradation and plasticity. The soil name should be capitalized.

Examples of acceptable soil names are illustrated by the following descriptions:

- A soil sample is visually estimated to contain 15 percent gravel, 55 percent sand, and 30 percent fines (passing No. 200 sieve). The fines are estimated as either low or highly plastic silt. This visual classification is SILTY SAND WITH GRAVEL, with a Group Symbol of (SM).
- Another soil sample has the following visual estimate: 10 percent gravel, 30 percent sand, and 60 percent fines (passing the No. 200 sieve). The fines are estimated as low plastic silt. This visual classification is SANDY SILT. The gravel portion is not included in the soil name because the gravel portion was estimated as less than 15 percent. The Group Symbol is (ML).

The gradation of coarse-grained soil (more than 50 percent retained on No. 200 sieve) is included in the specific soil name in accordance with ASTM D 2488-93. There is no need to further document the gradation. However, the maximum size and angularity or roundness of gravel and sand-sized particles should be recorded. For fine-grained soil (50 percent or more passing the No. 200 sieve), the name is modified by the appropriate plasticity/elasticity term in accordance with ASTM D 2488-93.

Interlayered soil should each be described starting with the predominant type. An introductory name, such as "Interlayered Sand and Silt," should be used. In addition, the relative proportion of each soil type should be indicated (see Table 1 for example).

Where helpful, the evaluation of plasticity/elasticity can be justified by describing results from any of the visual-manual procedures for identifying fine-grained soils, such as reaction to shaking, toughness of a soil thread, or dry strength as described in ASTM D 2488-93.

## F. Group Symbol

The appropriate group symbol from ASTM D 2488-93 must be given after each soil name. The group symbol should be placed in parentheses to indicate that the classification has been estimated.

In accordance with ASTM D 2488-93, dual symbols (e.g., GP-GM or SW-SC) can be used to indicate that a soil is estimated to have about 10 percent fines. Borderline symbols (e.g., GM/SM or SW/SP) can be used to indicate that a soil sample has been identified as having properties that do not distinctly place the soil into a specific group. Generally, the group name assigned to a soil with a borderline symbol should be the group name for the first symbol. The use of a borderline symbol should not be used indiscriminately. Every effort should be made to first place the soil into a single group. Grain size is estimated in accordance with ASTM D 2488-93 (Table 2).

## G. Color

The color of a soil must be given. The color description should be based on the Munsell system. The color name and the hue, value, and chroma should be given.

## H. Moisture Content

The degree of moisture present in a soil sample should be defined as dry, moist, or wet. Moisture content can be estimated from the criteria listed on Table 3.

## I. Relative Density or Consistency

Relative density of a coarse-grained (cohesionless) soil is based on N-values (ASTM D 1586-84). If the presence of large gravel, disturbance of the sample, or non-standard sample collection makes determination of the in situ relative density or consistency difficult, then this item should be left out of the description and explained in the Comments column of the soil boring log.

Consistency of fine-grained (cohesive) soil is properly based on results of pocket penetrometer or torvane results. In the absence of this information, consistency can be estimated from N-values. Relationships for determining relative density or consistency of soil samples are given in Tables 4 and 5.

## J. Soil Structure, Mineralogy, and Other Descriptors

Discontinuities and inclusions are important and should be described. Such features include joints or fissures, slickensides, bedding or laminations, veins, root holes, and wood debris.

Significant mineralogical information such as cementation, abundant mica, or unusual mineralogy should be described.

Other descriptors may include particle size range or percentages, particle angularity or shape, maximum particle size, hardness of large particles, plasticity of fines, dry strength, dilatancy, toughness, reaction to HCl, and staining, as well as other information such as organic debris, odor, or presence of free product.

K. **Equipment and Calibration**

Before starting the testing, the equipment should be inspected for compliance with the requirements of ASTM D 1586-84. The split-barrel sampler should measure 2-inch or 3-inch O.D., and should have a split tube at least 18 inches long. The minimum size sampler rod allowed is "A" rod (1-5/8-inch O.D.). A stiffer rod, such as an "N" rod (2-5/8-inch O.D.), is required for depths greater than 50 feet. The drive weight assembly should consist of a 140-pound or 300-pound hammer weight, a drive head, and a hammer guide that permits a free fall of 30 inches.

# IV. Attachments

Soil Boring Log, CH2M HILL Form D1586, and a completed example

ASTM D 2488-90: Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).

# V. Key Checks and Preventive Maintenance

Check entries to the soil-boring log and field logbook in the field; because the samples will be disposed of at the end of fieldwork, confirmation and corrections cannot be made later. Check that sample numbers and intervals are properly specified. Check that drilling and sampling equipment is decontaminated using the procedures defined in SOP Decontamination of Drilling Rigs and Equipment.

# Direct-Push Soil Sample Collection

## I. Purpose

To provide a general guideline for the collection of soil samples using direct-push (e.g., Geoprobe®) sampling methods.

## II. Scope

Standard direct-push (e.g., Geoprobe®) soil sampling methods.

## III. Equipment and Materials

- Truck-mounted hydraulic percussion hammer.
- Sampling rods
- Sampling tubes and acetate liners (if desired)
- Pre-cleaned sample containers and stainless-steel sampling implements
- Clean latex or surgical gloves.

## IV. Procedures and Guidelines

1. Decontaminate sampling tubes and other non-dedicated downhole equipment in accordance with SOP *Decontamination of Personnel and Equipment.*
2. Drive sampling tube to the desired sampling depth using the truck-mounted hydraulic percussion hammer. If soil above the desired depth is not to be sampled, first drive the lead rod, without a sampling tube, to the top of the desired depth.
3. Remove the rods and sampling tube from the borehole and remove the sample from the tube.
4. Fill all sample containers, beginning with the containers for VOC analysis, using a decontaminated or dedicated sampling implement.
5. Decontaminate all non-dedicated downhole equipment (rods, sampling tubes, etc.) in accordance with SOP *Decontamination of Personnel and Equipment.*
6. Backfill borehole at each sampling location with grout or bentonite and repair the surface with like material (bentonite, asphalt patch, concrete, etc.), as required.

# V. Key Checks and Items

1. Verify that the hydraulic percussion hammer is clean and in proper working order.
2. Ensure that the direct-push operator thoroughly completes the decontamination process between sampling locations.
3. Verify that the borehole made during sampling activities has been properly backfilled.

STANDARD OPERATING PROCEDURE

# Field Rinse Blank Preparation

## I. Purpose

To prepare a blank to determine adequacy of decon procedures and whether any cross-contamination is occurring during sampling.

## II. Scope

The general protocols for preparing the rinse blank are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

## III. Equipment and Materials

- Blank liquid (use ASTM Type II grade water)
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

## IV. Procedures and Guidelines

A. Decontaminate all sampling equipment that has come in contact with sample according to SOP Decontamination of Personnel and Equipment.

B. To collect the sample for volatiles analysis, pour blank water over one piece of equipment and into 40-ml vials until there is a positive meniscus and seal vials. Note the sample number and associated piece of equipment in the field notebook.

For non-volatiles, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

C. Document and ship samples in accordance with the procedures for other samples.

D. Collect next field sample.

# V. Attachments

None.

# VI. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II grade water.

STANDARD OPERATING PROCEDURE

# Homogenization of Soil and Sediment Samples

## I. Purpose

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample.

## II. Scope

Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for TCL VOCs or field GC screening; samples for these analyses should NOT be homogenized.

## III. Equipment and Materials

Sample containers, stainless steel spoons or spatulas, and stainless steel pans.

## IV. Procedures and Guidelines

Soil and sediment samples to be analyzed for semivolatiles, pesticides, PCBs, metals, cyanide, or field XRF screening should be homogenized in the field. After a sample is taken, a stainless steel spatula should be used to remove the sample from the split spoon or other sampling device. To prohibit the introduction of organic interferences into the sample, only utilize a stainless steel spatula to remove the sample from the split spoon or other sampling device.

Samples for VOCs should be taken immediately upon opening the spoon and should not be homogenized.

Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample. The sample should be placed in a decontaminated stainless steel pan and thoroughly mixed using a stainless steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, and then rolled to the center of the pan and mixed with the entire sample again.

All stainless steel spoons, spatulas, and pans must be decontaminated following procedures specified in SOP Decontamination of Personnel and Equipment prior to homogenizing the sample. A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

# Packaging and Shipping Procedures

## I. Low-Concentration Samples

A. Prepare coolers for shipment:

- Tape drains shut.
- Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
- Place mailing label with laboratory address on top of coolers.
- Fill bottom of coolers with about 3 inches of vermiculite.

B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.

C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape.

D. Seal each sample bottle within a separate ziplock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.

E. Arrange sample bottles in coolers so that they do not touch.

F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.

G. Fill remaining spaces with vermiculite.

H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.

I. Separate copies of forms. Seal proper copies (traffic reports, packing lists) along with a return address label within a large zip-lock bag and tape to inside lid of cooler.

J Close lid and latch.

K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.

L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. **Do not** cover custody seals.

M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

## II. Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with several additional restrictions. First, a special airbill including a Shipper's Certification for Restricted Articles is required. Second, "Flammable Liquid N.O.S." or "Flammable Solid N.O.S." (as appropriate) labels must be placed on at least two sides of the cooler. Third, sample containers are packaged in metal cans with lids before being placed in the cooler, as indicated below:

- Place approximately ½ inch of vermiculite in the bottom of the can.
- Position the sample jar in the zip-loc bag so that the sample tags can be read through the plastic bag.
- Place the jar in the can and fill the remaining volume with vermiculite.
- Close the can and secure the lid with metal clips.
- Write the traffic report number on the lid.
- Place "This Side Up" and "Flammable Liquid N.O.S." or "Flammable Solid N.O.S." (as appropriate) labels on the can.
- Place the cans in the cooler.
- For medium concentration samples, ship samples with ice or "blue ice" inside the coolers. (Double bag ice in zip-lock plastic bags.)

## III. Special Instructions for Shipping Medium and High Concentration Samples by Federal Express

A. Label cooler as hazardous shipment:

- Write shipper's address on outside of cooler. If address is stenciled on, just write "shipper" above it.
- Write or affix sticker saying "This Side Up" on two adjacent sides.
- Write or affix sticker saying "ORM-E" with box around it on two adjacent sides. Below ORM-E, write NA#9188.
- Label cooler with "Hazardous Substance, N.O.S." and "liquid" or "solid," as applicable.

B. Complete the special shipping bill for restricted articles.

- Under Proper Shipping Name, write "Hazardous Substance, N.O.S." and "liquid" or "solid," as applicable.
- Under Class, write "ORM-E.
- "Under Identification No., write NA No. 9188.

C. For high concentration samples, ship samples with "blue ice" only inside coolers.

STANDARD OPERATING PROCEDURE

# Chain-of-Custody

## I Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures to be used under the CLEAN Program.

## II Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site-specific requirements for chain-of-custody.

## III Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

# IV Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is responsible for ensuring that chain-of-custody procedures are implemented. The Project Manager also is responsible for determining that custody procedures have been met by the analytical laboratory.

Field Team Leader - The Field Team Leader is responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper or laboratory. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Sample Personnel - It is the responsibility of the field sampling personnel to initiate chain-of-custody procedures, and maintain custody of samples until they are relinquished to another custodian, the sample shipper, or to a common carrier.

# V Procedures

The term “chain-of-custody” refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

## V.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When in-situ measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s);
- CTO Number;
- Project Sample Number;
- Sample location or sampling station number;
- Date and time of sample collection and/or measurement;

- Field observations;
- Equipment used to collect samples and measurements; and,
- Calibration data for equipment used.

Measurements and observations shall be recorded using waterproof ink.

### V.1.1 Sample Label

Samples, other than in-situ measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label (see Attachment A). Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project - Contract Task Order (CTO) Number.
- Station Location - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 12/21/85).
- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name of the sampler.
- Remarks - Any pertinent additional information.

Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identify of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site).

## V.2 Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed.

### V.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.

- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once developed, the photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographs will be stored in the project files. It is good practice to identify sample locations in photographs by including an easily read sign with the appropriate sample/location number.

- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions, e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.

### V.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. A Chain-of-Custody Record Form example is shown in Attachment B. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below.

- Enter header information (CTO number, samplers, and project name).

- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).

- Sign, date, and enter the time under "Relinquished by" entry.

- Have the person receiving the sample sign the "Received by" entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).

- If a carrier is used, enter the airbill number under "Remarks," in the bottom right corner;

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample shipping package. Retain the copy with field records.

- Sign and date the custody seal, a 1- by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.

- Place the seal across the shipping container opening so that it would be broken if the container were to be opened.
- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

# VI Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

# VII Attachments

Sample Label
Chain of Custody Form
Custody Seal

# VIII References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA / 540 / P-91 / 002), January 1991.

**Chain- of- Custody**
**Attachment A**
# Example Sample Label

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

| | |
|---|---|
| SAMPLE ID | SAMPLE DATE |
| SAMPLED BY | SAMPLE TIME |
| PRESERVATIVE | ______ GRAB<br>______ COMPOSITE |

ANALYSIS REQUESTED


P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

| | |
|---|---|
| SAMPLE ID | SAMPLE DATE |
| SAMPLED BY | SAMPLE TIME |
| PRESERVATIVE | ______ GRAB<br>______ COMPOSITE |

ANALYSIS REQUESTED

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

| | |
|---|---|
| SAMPLE ID | SAMPLE DATE |
| SAMPLED BY | SAMPLE TIME |
| PRESERVATIVE | ______ GRAB<br>______ COMPOSITE |

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800-255-3950 • 304-255-3900
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PROJECT NAME

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|---|---|
| SAMPLE ID | SAMPLE DATE |
| SAMPLED BY | SAMPLE TIME |
| PRESERVATIVE | ______ GRAB<br>______ COMPOSITE |

ANALYSIS REQUESTED

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

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|---|---|
| SAMPLE ID | SAMPLE DATE |
| SAMPLED BY | SAMPLE TIME |
| PRESERVATIVE | ______ GRAB<br>______ COMPOSITE |

ANALYSIS REQUESTED

P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME

| | |
|---|---|
| SAMPLE ID | SAMPLE DATE |
| SAMPLED BY | SAMPLE TIME |
| PRESERVATIVE | ______ GRAB<br>______ COMPOSITE |

ANALYSIS REQUESTED

**Chain–of -Custody**
**Attachment B**

# Example Chain-of-Custody Record

# Chain of Custody Record

STL-4124 (0901)

| Client | Project Manager | Date | Chain of Custody Number 170424 |
|---|---|---|---|
| Address | Telephone Number (Area Code)/Fax Number | Lab Number | Page ______ of __ |

| City | State | Zip Code | Site Contact | Lab Contact | Analysis (Attach list if more space is needed) |
|---|---|---|---|---|---|
| Project Name and Location (State) | | | Carrier/Waybill Number | | |
| Contract/Purchase Order/Quote No. | | | Matrix | Containers & Preservatives | Special Instructi[ons/] Conditions of Re[ceipt] |

| Sample I.D. No. and Description (Containers for each sample may be combined on one line) | Date | Time | Air | Aqueous | Sed. | Soil | | Unpres. | H2SO4 | HNO3 | HCl | NaOH | ZnAc/ NaOH | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Possible Hazard Identification

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other________

QC Requirements (Specify)

| | Date | Time | | Date | Time |
|---|---|---|---|---|---|
| 1. Relinquished By | | | 1. Received By | | |
| 2. Relinquished By | | | 2. Received By | | |
| 3. Relinquished By | | | 3. Received By | | |

Comments

**DISTRIBUTION:** WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

A.W. Greenwood Associates (215) 441-4224

**Chain- of- Custody**
**Attachment C**
## Example Custody Seal

CUSTODY SEAL

DATE ____________________

SIGNATURE ____________________

QEC
Quality Environmental Containers
800-255-3950 • 304-255-3900

CUSTODY SEAL

DATE ____________________

SIGNATURE ____________________

QEC
Quality Environmental Containers
800-255-3950 • 304-255-3900

STANDARD OPERATING PROCEDURE

# Decontamination of Drilling Rigs and Equipment

## I. Purpose and Scope

The purpose of this guideline is to provide methods for the decontamination of drilling rigs, downhole drilling tools, and water-level measurement equipment. Personnel decontamination procedures are not addressed in this SOP; refer to the site safety plan and SOP Decontamination of Personnel and Equipment. Sample bottles will not be field decontaminated; instead they will be purchased with certification of laboratory sterilization.

## II. Equipment and Materials

- Portable steam cleaner and related equipment
- Potable water
- Phosphate-free detergent such as Alconox or Liquinox
- Buckets
- Brushes
- Distilled organic-free water
- Methanol, pesticide grade
- Six-molar nitric acid, analytical grade
- ASTM–Type II grade water
- Aluminum foil

## III. Procedures and Guidelines

### A. Drilling Rigs and Monitoring Well Materials

Prior to the onset of drilling, after each borehole, prior drilling through permanent isolation casing, and prior to leaving the site, heavy equipment and machinery will be decontaminated by steam cleaning at a designated area. The steam cleaning area will be designed to contain decontamination wastes and waste waters and can be a HDPE-lined, bermed pad. A pumping system will be used to convey decontaminated water from the pad to drums.

Surface casings may be steam cleaned in the field if they are exposed to contamination at the site prior to use.

### B. Downhole Drilling Tools

Downhole tools will be steam cleaned prior to the onset of drilling, prior to drilling through permanent isolation casing, and between boreholes. This will include, but is not limited to, rods, split-spoons or similar samplers, coring equipment, augers, and casing.

Prior to the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for physical characterization, the sampler shall be cleaned by scrubbing with a detergent solution followed by a potable water rinse.

Prior to the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for chemical analysis, the sampler shall be decontaminated following the procedures outlined in the following subsection.

### C. Field Analytical Equipment

1. Water Level Indicators

   Water level indicators that consist of a probe that comes into contact with the groundwater must be decontaminated using the following steps:

   a. Rinse with tap water
   b. Rinse with deionized water
   c. Solvent rinse with methanol
   d. Rinse with deionized water

2. Probes

   Probes, for example, pH or specific ion electrodes, geophysical probes, or thermometers that would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise. For probes that make no direct contact, for example, OVM equipment, the probe will be wiped with clean paper-towels or cloth wetted with methanol.

## IV. Attachments

None.

## V. Key Checks and Preventative Maintenance

The effectiveness of field cleaning procedures will be monitored by rinsing decontaminated equipment with organic-free water and submitting the rinse water in standard sample containers for analysis. Any time a sampling event occurs, at least one such quality control sample shall be collected. The total number of equipment blanks will be at least 5 percent of the number of samples collected during large-scale field sampling efforts.

At least one piece of field equipment shall be selected for this procedure each time equipment is washed. An attempt should be made to select different pieces of equipment for this procedure.

STANDARD OPERATING PROCEDURE

# Decontamination of Personnel and Equipment

## I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

## II. Scope

This is a general description of decontamination procedures.

## III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water)
- Distilled water
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) trisodium phosphate ("TSP") and water solution
- Concentrated (V/V) pesticide grade methanol (DO NOT USE ACETONE)
- 10% (V/V) nitric acid ($HNO_3$) and water solution (only ultrapure grade $HNO_3$ is to be used)
- Large plastic pails or tubs for TSP and water, scrub brushes, squirt bottles for TSP, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Phthalate-free gloves
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

# IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in TSP solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with TSP solution, remove, and discard into DOT approved 55-gallon drum.
2. Wash outer gloves in TSP solution, rinse, remove, and discard into DOT approved 55-gallon drum.
3. Remove disposable coveralls ("Tyveks") and discard into approved 55-gallon drum.
4. Remove respirator (if worn).
5. Remove inner gloves and discard.
6. At the end of the work day, shower entire body, including hair, either at the work site or at home.
7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION—GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Spread plastic on the ground to keep hoses from touching the ground
3. Turn off pump after sampling. Remove pump from well and place pump in decontamination tube, making sure that tubing does not touch the ground
4. Turn pump back on and pump 1 gallon of TSP solution through the sampling pump.
5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).
6. Rinse with 10% $HNO_3$ solution pumped through the pump, when sampling for inorganics (carbon steel split spoons will be rinsed with a 1% solution).
7. Rinse with 1 gallon of tap water.
8. Rinse with 1 gallon of deionized water.
9. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.
10. Collect all rinsate and dispose of in a DOT approved 55-gallon drum.

C. SAMPLING EQUIPMENT DECONTAMINATION – OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Prior to entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with TSP solution.
5. Rinse with potable water.
6. Rinse with 10% $HNO_3$ solution when sampling for inorganics (carbon steel split spoons will be rinsed with a 1% solution).
7. Rinse with distilled or potable water and methanol solution (DO NOT USE ACETONE).
8. Air dry.
9. Rinse with deionized water.
10. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
11. Collect all rinsate and dispose of in a DOT approved 55-gallon drum.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with TSP solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT approved 55-gallon drum.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with TSP solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.
2. Dispose of all used paper towels in a DOT approved 55-gallon drum.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Navy
2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

# V. Attachments

None.

# VI. Key Checks and Items

- Clean with solutions of TSP, methanol, nitric acid, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.